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ABSTRACT

This is the second in a biennial series of reports designed to furnish a comprehensive overview of the status of U.S. scientific and technological efforts as they relate to the employment and other characteristics of science/engineering (S/E) personnel. The report begins with an integrated overview of current utilization and supply patterns for all U.S. scientists and engineers and the roles of women and minorities in science and engineering. Issues related to S/E personnel in universities are discussed, along with the role of precollege mathematics and science training on students' decisions to enter careers in science or engineering. The report concludes with an examination of the flows of scientists and engineers into and out of science and engineering. Appendix tables provide a comprehensive summary of data on S/E personnel. (JN)

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science and engineering personnel: a national overview

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foreword

This is the second in a biennial series of reports designed to furnish a comprehensive overview of the status of U.S. scientific and technological efforts as they relate to the employment and other characteristics of science/engineering personnel. It provides a perspective or framework for analyzing issues relating to these personnel.

The report begins with an integrated overview of current utilization and supply patterns for all U.S. scientists and engineers, including an examination of the status of doctoral scientists and engineers and the roles of women and minorities in science and engineering. Issues relating to science/engineering personnel in universities and industry are discussed, along with the role of precollege mathematics and science training on students' decisions to enter careers in engineering or science. The report concludes with an examination of the flows of scientists and engineers into and out of science and engineering. Appendix tables provide a comprehensive summary of data on these personnel that should be of special value to analysts.

This publication is a useful complement to the *National Patterns of Science and Technology Resources* series and the National Science Board's periodic *Science Indicators* series, both developed by the Division of Science Resources Studies. Comments and suggestions are invited so that future volumes will continue to reflect the information needs of policymakers and others concerned with U.S. efforts in science and technology.

Charles E. Falk
Director, Division of Science
Resources Studies
Directorate for Scientific,
Technological, and
International Affairs

August 1982

acknowledgments

This report was developed by Michael F. Crowley, Senior Staff Associate for Methods and Analyses, Scientific and Technical Personnel Studies Section (STPSS). Significant contributions to the report were provided by Melissa J. Lane and John A. Scopino.

Supervision, review, and guidance were provided by Alan Fechter, Head, STPSS, and by Charles E. Falk, Director, Division of Science Resources Studies.

notes

- Concepts and definitions underlying much of the data in this report as well as the major data sources are presented in appendix A.
- Many of the statistics presented are subject to both sampling and nonsampling error. Readers are urged to review the statistical limitations of the data presented in appendix A.
- The mathematical model used to generate national estimates of U.S. scientists and engineers was recently changed. Thus, some of the 1976 and 1978 statistics presented are different from those appearing in earlier publications.

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summary

trends in employment

Job opportunities for scientists and engineers in the United States continued to expand between 1978 and 1980 as employment in science and engineering (S/E) activities increased by 7 percent to 2.6 million. This rate of increase was slower than the 14 percent experienced during 1976-78 as the economy recovered from the recession of the midseventies, but it was still substantially greater than the 3 percent experienced by the total work force. Although the rate was slightly below the 10-percent growth that occurred in employment of professional, technical, and kindred workers, the strong showing suggests that science and engineering are still benefiting from the growing share of economic activities that require high levels of training and skill.

Fueled by rapid growth among computer specialists and life scientists, employment of scientists in S/E activities grew more rapidly than the comparable employment of engineers between 1978 and 1980 (10 percent versus 3 percent). The slower growth for engineers may be the result of supply constraints that make it difficult to find enough qualified engineers to fill the available jobs.

Over two-thirds of the employment growth for scientists was accounted for by the growth in computer specialists and life scientists. Lower growth rates were experienced by most of the remaining fields; a 2.5-percent decline was noted for physical sciences. Among the different engineering fields, there was less variation during the 1978-80 period, with the largest increase recorded for electrical and electronics engineers (about 7 percent) and the smallest for "other" engineers (about 1 percent).

Between 1978 and 1980, employment of scientists and engineers primarily engaged in R&D activity grew twice as fast as employment in non-R&D activities—14 percent versus 7 percent.

market conditions

A variety of labor market indicators show that shortages appear to exist for scientists and engineers with computer and some energy-related skills—i.e., computer specialists and electrical and petroleum engineers. Industrial employers of bachelor's- and master's-level graduates reported shortages of persons trained in computer science, systems analysis, and electrical, electronic, petroleum, and computer engineering. Employer perceptions of doctorate shortages were different, however, from those at the bachelor's and master's levels. A majority of employers reported adequate or surplus numbers of Ph.D. applicants in computer science, systems analysis, electrical, electronic, and mechanical engineering, and the earth sciences. On the other hand, over 40 percent of the employers of chemical engineering doctorates reported shortages in that field. Shortages were concentrated in industries that had experienced overall employment growth in 1981—office machine (computer) manufacturing, electronic component manufacturing, computer and data processing services, and petroleum extraction.

Scientists and engineers rarely experience much difficulty in finding employment, and the situation in the early eighties continues to reflect this pattern. The unemployment rate for scientists and engineers remained at about 1 percent in 1978 and 1980, down from roughly 2 percent in 1976.

The proportion of the S/E labor force employed in S/E jobs, the S/E utilization rate, remained at about 90 percent for the entire period. Of the 550,000 scientists and engineers who were not employed in S/E activity, most were either not in the labor force (and therefore not looking for work) or employed in non-S/E jobs (205,000 and 314,000, respectively). Relatively few (about 10 percent) of those not employed in S/E activity had chosen other jobs because they could not find S/E jobs.

There was, however, notable variation among fields in both the unemployment and the S/E utilization rates, particularly among the science fields. In general, unemployment rates were higher (ranging around 2 percent) and S/E utilization rates were lower (ranging around 80 percent to 85 percent) in science fields experiencing relatively slow rates of employment growth—e.g., social, physical, and environmental sciences. Similar, but more dramatic, variation in these rates was displayed by 1978 and 1979 baccalaureate graduates with degrees in S/E fields.

sectoral patterns and trends

Most scientists and engineers (about 59 percent) are employed in business/industry. Educational institutions are the second largest employment sector, with 18 percent of all employed scientists and engineers. The Federal Government, with 9 percent, is third. These sectoral distributions have changed little since the midseventies.

Although the sectoral distribution has remained relatively stable, growth patterns have varied considerably among sectors. The 1978-80 growth rate of scientists and engineers employed in business/industry declined substantially compared to the growth rate of the midseventies; the average annual rate for

1978-80 was about 4 percent, compared to a growth rate of 11 percent per year during 1976-78.

Employment growth in educational institutions was slightly higher in 1978-80 than in 1976-78 (10 percent versus 9 percent). This slight acceleration in growth masks the fact that an increasing share of employment in educational institutions is in part-time or nontenure-track positions. Educational institutions have grown increasingly reluctant to hire into tenure-track positions because of the expected demographically driven slowdown in enrollment growth and because of the increasing share of tenured faculty. As a result, the share of total faculty members who are "recent" doctorates (i.e., received degrees within the last seven years) has been declining—from 39 percent in 1968 to 21 percent in 1980, a level that many departmental chairmen consider undesirable.

In contrast to the static overall academic market, however, departments of engineering and computer sciences are unable to fill all their vacancies. In 1980, for instance, roughly 10 percent of engineering faculty positions were unfilled. This may be attributed primarily to an inadequate flow of new doctorates to academia. One reason for this may be the relatively lucrative salaries offered to new engineering baccalaureates, which have acted as a significant disincentive to those who might have continued graduate-level engineering training.

Employment opportunities in the Federal Government were less favorable than those in other large employment sectors, reflecting recent policies of reduced Federal spending and employment. Between 1978 and 1980, employment of scientists and engineers increased by about 6 percent, which is slightly less than the 7-percent increase experienced between 1976 and 1978.

doctoral scientists and engineers

In the late seventies, employment of scientists and engineers holding doctorates grew by about the same 10 percent rate as that of all scientists and engineers, reaching almost 314,000 in 1979. Computer specialists experienced an annual average employment increase of 8 percent between 1977 and 1979, down from the extraordinary 21-percent average annual increase that occurred between 1973 and 1977. While still the fastest growing field among S/E doctorates, computer specialists comprised only about 2 percent of the employed S/E doctorates in 1979. Strong employment growth rates were also noted in psychology and the social sciences, but below-average employment increases in the physical and mathematical sciences were experienced between 1977 and 1979.

Relative employment of S/E doctorates continued a gradual shift to business/industry from educational institutions and the Federal Government. Between 1973 and 1979, employment in business/industry grew by almost 8 percent per year, while employment in educational institutions and employment in the Federal Government each increased about 5 percent. Despite this shift, however, educational institutions continued to be the major employer of S/E doctorates, accounting for more than one-half of their total employment.

Research and development replaced teaching as the largest primary work activity for scientists and engineers in 1977, primarily because of the slow growth in teaching opportunities. The proportion of S/E doctorates reporting teaching as their primary work activity fell sharply (from 36 percent to 29 percent) between 1973 and 1979.

women and minorities

Women scientists and engineers continue to increase their share of the S/E work force. Between 1978 and 1980, employment of women rose more than 5 times faster than employment of men (32 percent versus 6 percent). Despite this dramatic growth, women represented about 13 percent of the S/E work force in 1980, compared to about 40 percent of professional, technical, and kindred workers. The number and proportion of women Ph.D. scientists and engineers continued to grow rapidly between 1977 and 1979. The average annual rate of increase for these women was 10 percent between 1973 and 1979, more than twice that of men. Women as a proportion of total Ph.D. scientists and engineers increased from 9 percent to 11 percent during this period.

Although employment of members of minority groups grew more rapidly than employment of whites between 1978 and 1980 (17 percent for blacks and 11 percent for Asians versus 8 percent for whites), the distribution of scientists and engineers by race remained relatively stable. Since 1976, the black share of the S/E work force has inched up to almost 2 percent in 1980, compared to about 7 percent of professional, technical, and kindred workers. For Asians, the 1980 share was about 2.5 percent. No strong trends were observed among any of the racial minority groups.

The number of minority Ph.D. scientists and engineers increased rapidly (37 percent) between 1977 and 1979. Over the longer period (1973-79), this population more than doubled, representing a growth rate three times that for nonminorities. Proportionately, minority Ph.D. scientists and engineers rose from 5 percent to 8 percent of the total between 1973 and 1979, with the largest gains among Asians, who comprise 80 percent of minority S/E doctorates. Blacks, however, remained at only 1 percent of all Ph.D. scientists and engineers.

the dynamics of s/e labor markets

Changes in the supply of scientists and engineers are achieved through flows of personnel into and out of the S/E labor market, beginning with the precollege environment that produces the potential new supply of scientists and engineers.

the precollege environment

The distribution of high school students by type of curriculum is an important determinant of the number and type of mathematics and science courses taken. Students in academic programs generally take more mathematics and science courses than students in either general or vocational programs.

Thirty-nine percent of the 1980 high school seniors were enrolled in academic programs. While this represents a decline of 4 percentage points from 1972, this decline is offset by an increase (almost 3 percent) in the number of high school graduates between 1972 and 1980. Although the number enrolled in academic programs did not decline significantly during this period, the decline may become more serious in the eighties as the number of high school graduates, driven by demographic factors, begins to fall.

Performance of students on various mathematics and science achievement tests has also deteriorated, particularly at the high school level. On the Scholastic Aptitude Tests administered between 1970 and 1981, verbal scores declined 36 points (460 to 424) and mathematics scores declined 22 points (488 to 466). This steady decline is not evident, however, among high school seniors intending to major in an S/E field in college.

degree production

The number of degrees granted in S/E fields continued to decline slowly, to about 290,000 in 1980 at the bachelor's-degree level and about 17,000 at the doctorate level. Degree production at the master's-degree level has remained steady at about 55,000 annually.

At the baccalaureate level, dramatic increases were experienced in engineering and computer specialties. Analysis of the increase in S/E baccalaureate production between 1955 and 1980 revealed that only 40 percent of this increase could be attributed to demographic factors. The share of S/E bachelor's degrees earned by women increased to 36 percent in 1980, up from 12 percent in 1950.

Future demographic trends are not expected to contribute to growth in S/E degree production. The strong current job and salary opportunities for engineers and computer specialists, however, are expected to fuel a continuation in the growth in degrees for these fields in the immediate future. Similar conclusions about the role of demographic factors and the increasing share of female S/E degree recipients are applicable to the production of S/E master's degrees and doctorates.

transition from school to work

Only a fraction of S/E bachelor's-degree recipients are employed in S/E occupations within two years after graduation. Many postpone entry into the labor force by pursuing full-time graduate degrees (roughly 23 percent of the S/E bachelor's-degree recipients and 22 percent of the S/E master's-degree recipients in 1978 and 1979). In addition, many of those who enter the labor force are employed in non-S/E occupations (almost one-half of the 1978 and 1979 S/E bachelor's-degree recipients in 1980 and about one-fifth of the comparable master's-degree recipients). Holders of baccalaureates in social, mathematical, and physical sciences have a relatively low success rate in finding S/E jobs, which is in part the result of requirements for advanced degrees for professional standing in these fields. Job opportunities for S/E graduates at all degree levels are becoming increasingly concentrated in the industrial sector.

interfield mobility

An additional source of change in S/E supply comes from experienced scientists and engineers entering and leaving S/E occupations. Roughly 20 percent of those employed in S/E jobs in 1972 had changed occupations by 1978. Of those changing occupations, one-half had moved to management positions, one-fourth to non-S/E jobs, and the remainder to different S/E occupations. In general, these flows occurred from fields in which employment demand was weak to fields in which employment demand was strong, such as the strong flow to engineering and computer specialties from mathematics. Similar mobility patterns were noted for inexperienced scientists and engineers.

Mobility between S/E and non-S/E jobs can affect S/E labor market situations. For example, of the almost 175,000 individuals trained in science or engineering who were not employed in technical and related occupations in 1972, more than 67,000 (35 percent) had entered S/E jobs by 1978 (the last year for which data are available). Offsetting this inflow, approximately 175,000 scientists and engineers working in S/E jobs in 1972 either moved to managerial or to other non-S/E jobs by 1978.

chapter I

utilization and supply patterns of scientists and engineers

In this chapter, the current situation for scientists and engineers is assessed in terms of the balance between demand and supply. The chapter begins with an examination of current utilization patterns for all scientists and engineers. It focuses on those employed in S/E jobs and describes recent trends and distributions by type of work activity and sector of the economy. These distributions are provided to describe in more detail the nature of the scientific and technical activity of these scientists and engineers. Specific attention is devoted to utilization and S/E personnel issues in industry and universities.

The analysis then shifts to an assessment of the supply-demand situation in these labor markets. Various indicators of current labor market conditions, including unemployment rates, S/E utilization rates, and salaries, are examined. In addition, estimates of projected future labor market conditions are summarized. The chapter concludes with analyses of the supply and utilization of subgroups of scientists and engineers that are of particular policy interest because of their distinctive role (doctoral scientists and engineers) or because of their low rates of participation (women and minorities) in these labor markets.

It should be noted that the total number of employed scientists and engineers includes both those working in S/E jobs and those with S/E training working in non-S/E jobs. The number employed in S/E jobs represents a measure of the utilization of S/E-trained personnel in the Nation's scientific and technological activities.

current s/e employment

Between 1978 and 1980, employment in S/E jobs increased by almost 7 percent, from 2.40 million to 2.56 million. Although this is considered a strong showing when compared with the 3-percent growth of the total work force, it is still only about one-half of the nearly 14-percent increase in S/E jobs experienced between 1976 and 1978. The 1976-78 figure, of course, reflects the exceptional growth that accompanied the recovery from the economic slowdown of the midseventies.

Growth in S/E employment varied significantly among fields (chart 1). Overall employment in science occupations increased by more than 10 percent, with substantial growth among mathematical scientists (20 percent), life scientists (16 percent), and computer specialists (14 percent). Computer specialists accounted for almost one-third of the total growth in scientific employment, although they represented only about one-fourth of all employed scientists. In contrast, employment of physical scientists in S/E jobs declined slightly, primarily because of a drop in the employment of physicists. This decline may reflect the movement of physical scientists to engineering jobs.[1]

During this 1978-80 period, engineering jobs increased by about 3 percent to over 1.2 million. Although there was some variation by field (chart 1), it was less among engineers than among scientists. Growth of engineering employment was inhibited by supply constraints; it would have been faster if additional engineers had been available.

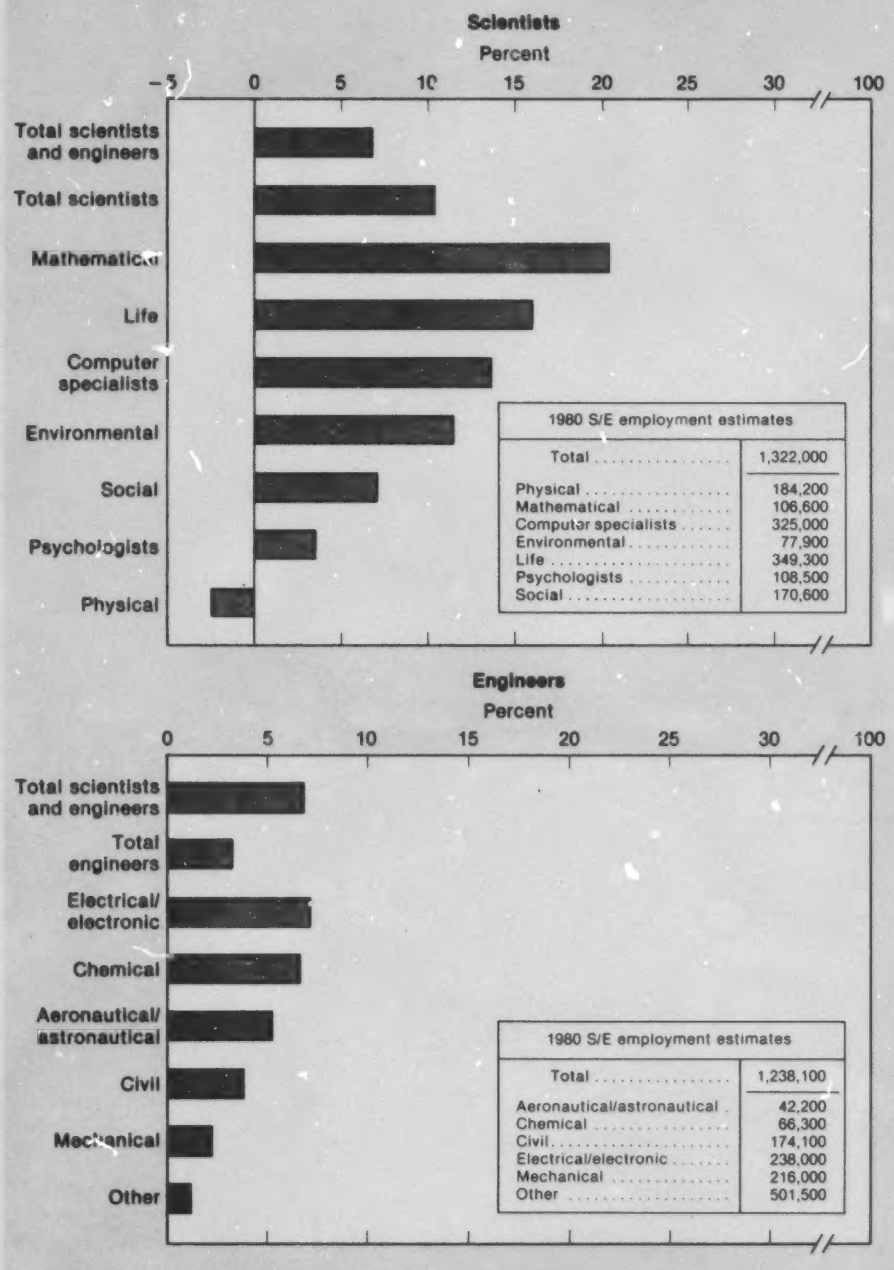
Employment of all scientists and engineers—in both S/E and other jobs—increased much more rapidly than total U.S. employment: 8.7 percent versus 3.1 percent. Gains for scientists and engineers did not, however, keep pace with the almost 10-percent increase in employment of all professional and technical workers.[2]

Employment of scientists increased 11 percent compared to the 6-percent increase in the employment of engineers. Increases among scientists were paced by above-average expansion among mathematical and life scientists and computer specialists

[1] National Science Foundation, *Occupational Mobility of Scientists and Engineers* (Special Report) (NSF 80-317) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office), p. 16.

[2] Includes occupations such as teachers, accountants, nurses, etc.

Chart 1. Change in science/engineering (S/E) employment by field: 1978-80



SOURCE: National Science Foundation; tables B-3 and B-4

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(chart 2). In the engineering fields, aeronautical, chemical, and electrical engineers each showed increases of about 10 percent.

The increase in the number of employed engineers was twice that in the number of engineers employed in S/E jobs. This reflects the movement of engineers to jobs outside of engineering, generally in response to higher pay or better promotional opportunities.[3] It is interesting to note that over one-third of those employed engineers not in engineering jobs in 1980 were engaged in management activities (other than research and development). Between 1978 and 1980, there was an increase of 23 percent in the number of those with engineering backgrounds working as managers rather than engineers.

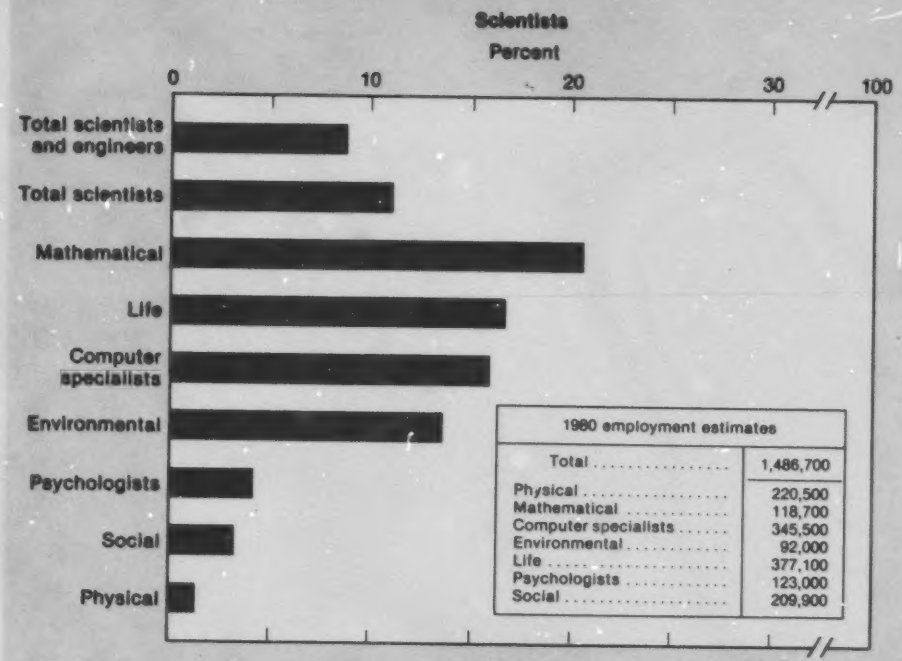
character of science and technology activities

The work activities of scientists and engineers, as measured by the number, proportion, and distribution of those doing research and development, teaching, and other activities, are a direct indicator of the character of U.S. science and technology. The character of these activities, however, varies considerably in different sectors of the economy. Thus, variations in sectoral employment patterns can indicate change in the character of the science and technology enterprise, and these changes reflect the myriad decisions that drive U.S. science and technology.

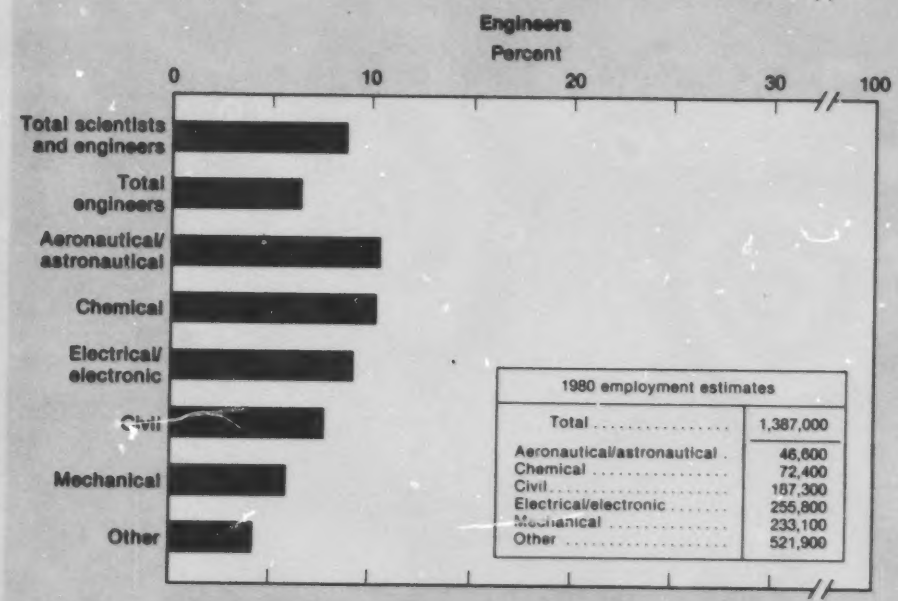
Between 1978 and 1980, there was a 14-percent increase in the number of scientists and engineers primarily engaged in research and development; the increase was 11 percent between 1976 and 1978. Research and development was the primary work activity of about 28 percent of the Nation's scientists and engineers in 1980 (chart 3), and an additional 8 percent of all scientists and engineers were in R&D management and administration. Thus, well over one-third (36 percent) were involved in some aspect of R&D activity. Engineers were more likely than scientists

[3] In 1978, of those engineers outside of science and engineering, 43 percent reported promotional opportunities as their major reason for non-S/E employment, 14 percent reported preferring a non-S/E job, 7 percent reported better pay, 6 percent cited locational preference, and only 8 percent reported a belief that an S/E job was not available (based on unpublished NSF data).

Chart 2. Change in employment of scientists and engineers by field: 1978-80



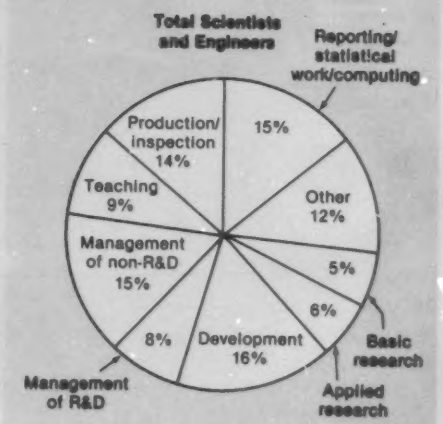
1980 employment estimates	
Total	1,486,700
Physical	220,500
Mathematical	118,700
Computer specialists	345,500
Environmental	92,000
Life	377,100
Psychologists	123,000
Social	209,900

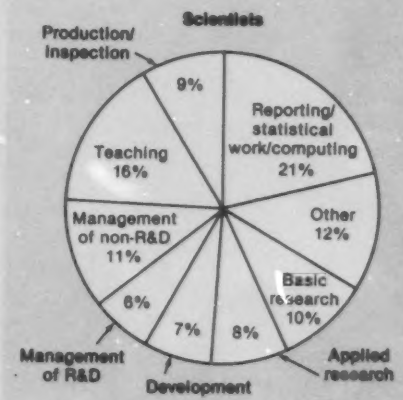


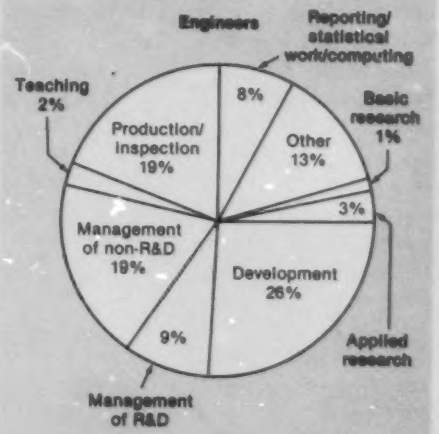
1980 employment estimates	
Total	1,387,000
Aeronautical/astronautical	46,600
Chemical	72,400
Civil	187,300
Electrical/electronic	255,800
Mechanical	233,100
Other	521,900

SOURCE: National Science Foundation; tables B-3 and B-4

Chart 3. Primary work activities of scientists and engineers: 1980







SOURCE: National Science Foundation; table B-8

(30 percent versus 25 percent) to be in some aspect of research and development and more likely than scientists to be in R&D management or administration. Over 57 percent of all scientists and engineers primarily engaged in the management or administration of R&D programs in 1980 were engineers.

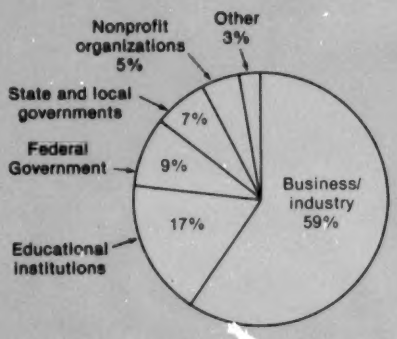
The primary activity of about 23 percent of scientists and engineers was management and administration (including R&D management). Of these, about one-third were involved principally in the management of R&D activities. Relatively more engineers than scientists (28 percent versus 18 percent) reported management as their primary activity.

About 9 percent of all scientists and engineers reported teaching as their primary work activity in 1980. The absolute increase in the number teaching (23,100 or 10 percent) was almost twice the increase between 1976 and 1978 (12,600 or 5 percent). Scientists are much more likely than engineers to report teaching as their primary work (16 percent versus 2 percent). This contrast is in part a result of differences in educational levels—a larger proportion of scientists than engineers hold doctorates (18 percent versus 4 percent) and thus are more likely to hold academic teaching positions.

Most scientists and engineers (59 percent or 1.7 million) worked in the business/industry sector in 1980 (chart 4). Educational institutions ranked a distant second (18 percent or 506,000). An additional 9 percent (248,000) worked for the Federal Government. Since the midseventies, the sectoral distribution of employed scientists and engineers has changed only slightly, with a small increase in the share in business/industry and slight declines in those employed by educational institutions and the Federal Government.

These sectoral shifts are more readily apparent among recent S/E graduates. In 1980, 65 percent of the 1978 and 1979 bachelor's level graduates were employed in industry and 9 percent were employed by educational institutions. In 1976, about 55 percent of bachelor-degree graduates from the classes of 1974 and 1975 found employment in business/industry, and 12 percent found employment in educational institutions. Changes at the master's level were even more dramatic. When 1978 and 1979 graduates were surveyed in 1980, 52 percent were in business/industry and 18 percent were in educational institutions. Comparable figures for 1974 and 1975 graduates surveyed in 1976 showed 37 percent in business/industry and 24 percent in educational institutions.

Chart 4. Employment of scientists and engineers by type of employer: 1980



SOURCE: National Science Foundation; table B-6

business/industry

Business/industry is the largest employer of both scientists (43 percent) and engineers (77 percent). Between 1978 and 1980, employment in business/industry increased by 9 percent, compared to 23 percent between 1976 and 1978. Engineering employment increased by 69,000 or approximately 7 percent, while employment of scientists increased by 72,000 or 13 percent, with substantial variation by field (chart 5).

Although business/industry employed over 40 percent of all scientists, employment opportunities varied considerably by field. For example, this sector employs almost 75 percent of all computer specialists and over 60 percent of all chemists but less than 25 percent of all social scientists.

Between 1978 and 1980, electrical and civil engineering were the fastest growing engineering specialties (chart 5), accounting for almost one-half of the total increase in engineering employment in this sector.

Of those scientists and engineers employed in business/industry in 1980, about 70 percent were located in only 7 major industries (table 1).[4] The largest employer

Table 1. Concentration of scientists and engineers in private industry: 1980

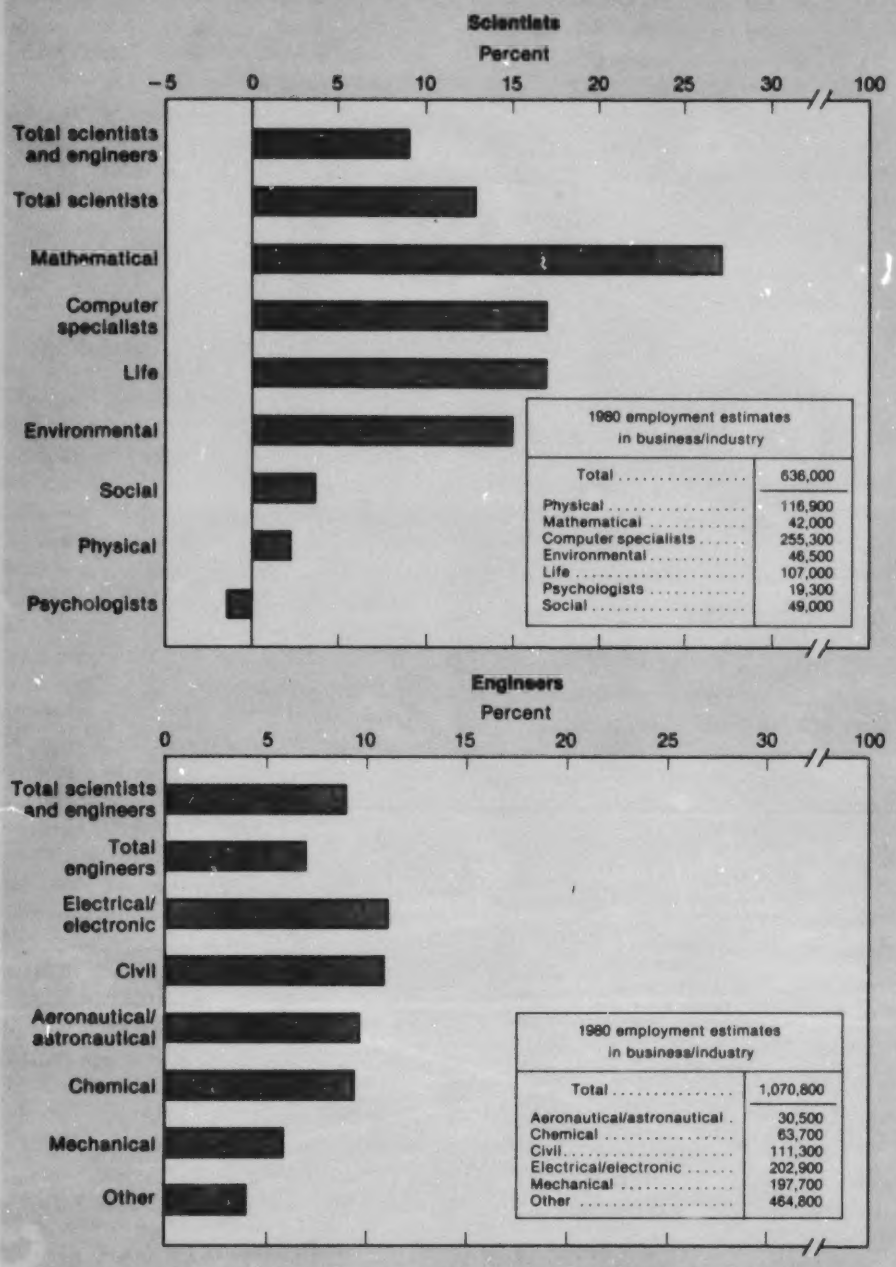
[5 percent or more]

Industry	Number	Percent
	Total scientists and engineers	
Total	1,281,000	100
Machinery	125,000	10
Office and computing machines	56,000	5
Electrical machinery	163,000	13
Communications equipment	93,000	8
Transportation equipment	143,000	12
Aircraft and parts	83,000	7
Chemicals	90,000	7
Durable goods wholesalers	58,000	5
Business services	132,000	11
Miscellaneous business services	98,000	8
Other services	151,000	12
Engineering and architectural services	122,000	10
	Scientists	
	Number	Percent
Total	320,000	100
Oil and gas extraction	20,000	7
Crude petroleum and natural gas	16,000	5
Chemicals	53,000	18
Drugs	20,000	7
Durable goods wholesalers	21,000	7
Insurance	20,000	7
Business services	67,000	22
Miscellaneous business services	42,000	14
Other services	32,000	11
	Engineers	
	Number	Percent
Total	961,000	100
Machinery	114,000	12
Office and computing machines	49,000	5
Electrical machinery	149,000	16
Communications equipment	84,000	9
Transportation equipment	132,000	14
Aircraft and parts	75,000	8
Business services	65,000	7
Miscellaneous business services	57,000	6
Other services	118,000	12
Engineering and architectural services	114,000	12

SOURCE: National Science Foundation

[4] National Science Foundation, *Scientists, Engineers, and Technicians in Private Industry: 1980* (Detailed Statistical Tables) (NSF 81-329) (Washington, D.C., 1982).

Chart 5. Change in employment of scientists and engineers in business/industry: 1978-80



SOURCE: National Science Foundation; table B-5

was the electrical machinery industry. Other industries employing 5 percent or more of industrially employed scientists and engineers included manufacturers of machinery (primarily office and computing machines), transportation equipment (primarily aircraft and parts), and chemicals, and firms engaged in wholesaling durable goods and providing business services (primarily R&D laboratories) and other services (primarily engineering and architectural services).

The industrial concentration of engineers is different from that of scientists (table 1). For example, the aircraft parts industry employed 8 percent of the engineers in private industry, but only 2.5 percent of the scientists. Excluding engineering and architectural services, engineers are generally concentrated in the durable goods manufacturing sector, while scientists are concentrated in service and nondurable goods manufacturing.

The computer specialists field generally is less concentrated than other occupations. Significant numbers of computer specialists are also found in trade, finance, insurance, and real estate.

A number of industries showed increases in S/E employment substantially above the 9-percent increase noted for all industries combined. As expected, the high-technology industries showed markedly higher increases. For example, employment of scientists and engineers in computer and data processing services increased by over 30 percent between 1978 and 1980. Industries showing increases of 20 percent or more include those that manufacture engineering and scientific instruments, guided missiles, and space vehicles; electronic components and accessories; aircraft and parts; and office, computing, and accounting machines. Some of the industries showing above-average increases in S/E employment are those experiencing rapid technological change and those in which U.S. firms have created and maintained comparative advantages over firms in other countries.

During the 1978-80 period, industries that comprise a significant part of the U.S. industrial base showed declines in S/E employment. Most notable of these were industries manufacturing primary and fabricated metals, textiles, and motor vehicles.[5]

[5] National Science Foundation, unpublished data.

Selected Personnel Issues. Management personnel in firms that employ large numbers of scientists and engineers identified a variety of issues: shortages of S/E personnel in several fields, obsolescence of skills caused by rapid technological change, and changes in mandatory retirement laws. Employers, however, indicated that very few scientists or engineers are postponing retirement because of changes in mandatory retirement legislation. Thus, they do not expect retirement legislation to alleviate recruitment problems by reducing the number hired to replace those who leave.

To help assess current labor market conditions in business/industry, the National Science Foundation (Division of Science Resources Studies) canvassed large- and medium-sized firms in a number of major industries to acquire information about the recruiting situation in the preceding year for recent S/E graduates.[6] Undertaken in late 1981, the study yielded the following findings:

- Shortages were concentrated in the computer and engineering fields. Forty percent or more of employers of bachelor's- and master's-level graduates reported shortages of persons trained in computer science, systems analysis, and electrical and electronics, petroleum, and computer engineering.
- There was a rough balance between supply and demand for bachelor's and master's graduates in the chemical, industrial, and mechanical engineering fields and in the earth sciences. Fields in which job applicants were in excess of needs included physics, mathematics, chemistry, and civil engineering.
- Employer perceptions of Ph.D. shortages differed from those at the bachelor's and master's levels. A large majority of employers of doctorates reported adequate or surplus numbers of job applicants in the fields of computer science and the earth sciences. On the other hand, over 40 percent of the employers of chemical engineering doctorates reported shortages in that field. (The number of responses regarding doctorates in computer, industrial, and petroleum engineering and in mathematics and physics, however, was not sufficient to assess market conditions.)
- A larger fraction of employers reported shortages of engineering graduates at each degree level than of science graduates. For example, over 40 percent of employers of bachelor's-degree recipients in engineering fields and 30 percent of the employers of bachelor's-degree recipients in science fields reported more vacancies than qualified applicants in these respective fields.
- Reported shortages were concentrated in industries that experienced overall employment growth in 1981—office machine (computer) manufacturing, electronic component manufacturing, computer and data processing services, and petroleum extraction.
- Large firms, on the average, sought proportionately more new workers than medium-sized firms. Medium-sized firms, however, were significantly more successful than larger organizations in meeting recruitment requirements.
- A large proportion (43 percent) of the employers reporting shortages felt that these were attributable to rapid growth of their industry. Over one-fourth attributed their shortages to competition from other industries. Two-fifths of the employers facing shortages increased their recruitment effort. Only 3 percent of those experiencing shortages noted that production of R&D levels were affected.

The second issue identified by industrial employers was the need for increased training that results from technological change. To help address this issue, NSF sponsored a study of the processes used by employers and employees in the computer manufacturing and other high-technology industries to cope with technological change.[7] The results of this study show that the computer manufacturing industry has provided considerably more formal and informal on-the-job training to its scientists and engineers than any other industry. Nearly half the scientists and engineers in the computer industry received formal training, and a third received informal training. Other high-technology industries typically provided between 15 percent and 30 percent of their scientists and engineers with formal training and less than 20 percent with informal training.

educational institutions

In 1980, educational institutions employed almost 5 percent (65,000) of all engineers and about 30 percent (441,000) of all scientists, making this sector the second largest employer of these personnel (chart 6). The 1978-80 employment growth in this sector (10.3 percent) was almost one-fifth above the rate for 1976-78 (8.7 percent).

Between 1978 and 1980, mathematical and life scientists experienced the largest relative growth in academic employment (more than 17 percent each). These trends reflect substantial increases in basic research funds for the life sciences, as well as an increasing number of bachelor's degrees granted in the computer sciences. Many mathematical scientists at universities and colleges are involved in teaching courses in support of computer programs.

Employment in some science fields is quite dependent on opportunities in educational institutions. For example, over 40 percent of all employed life and mathematical scientists are in educational institutions.

Overall employment growth in educational institutions may overstate job opportunities because of the increasing number of part-time jobs in this sector. A study funded by NSF[8] found that increases in employment of part-time personnel were primarily a result of economic and demographic factors. Beginning in the late sixties, declining rates of growth in enrollments forced educational institutions to adjust their number of full-time positions.

[6] National Science Foundation, "Science and Engineering Labor Markets for New Scientists and Engineers in Private Industry," *Science Resources Studies Highlights* (NSF 82-310) (Washington, D.C., June 9, 1982).

[7] William N. Cooke, *Human Capital Adjustments to Technological Change, The Case Study of Scientists and Engineers* (Springfield, Va.: National Technical Information Service).

[8] David A. Katz and Howard P. Tuckerman, "Part-Timers in the Seventies: A Trend in Academia," unpublished, 1978.

Part-time faculty are often less costly than full-time and are therefore a more flexible personnel resource.

Between 1980 and 1981, part-time employment increased by 8 percent, whereas full-time employment grew by only 2 percent.[9] This increase in part-time employment reflects an increase of almost 20 percent in part-time mathematical scientists and computer specialists. The increasing use of part-time personnel in this area results primarily from the difficulty that educational institutions have in hiring and retaining faculty in these fields because of the higher salaries offered by industry.

The more rapid growth of part-time employment compared to full-time employment represents a continuation of a trend evident since the early seventies. Between 1973 and 1980, part-time employment increased at an average annual rate of slightly over 5 percent (43 percent over the period), more than double the rate for full-time S/E personnel (2.4 percent per year or 18 percent over the period).[10] Between 1978 and 1980, employment of both full-time and part-time S/E personnel increased by about 2.7 percent per year (5.5 percent over the period). The slowdown in overall part-time hiring between 1978 and 1980 was traceable to declines in 2-year institutions.

Selected Personnel Issues. Universities and colleges face a number of issues with respect to scientists and engineers: (a) The impact of increasing foreign participation in higher education and in the S/E labor force; (b) the significance of postdoctorates in the Nation's research effort; (c) the shortage of engineering and computer science faculty; and (d) the high proportion of current S/E faculty holding tenure and the effect of this high rate on the decline of recent doctorates in academic employment. This section focuses on the latter two issues.

In the past five years, most engineering colleges have reported increased difficulty in staffing full-time faculty positions. Two factors accounting for this are the decline in the number of new engineering doctorates and increasing competition with industry for these new doctorates.

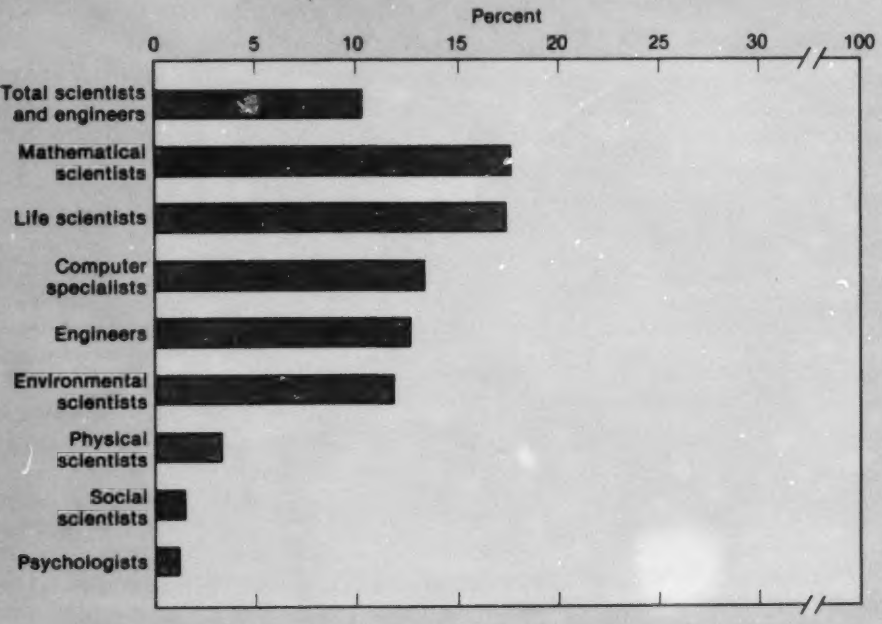
Currently all engineering fields have unfilled faculty positions. On the average, one in ten permanent, full-time engineering faculty positions was unfilled in fall 1980. The two fields with the highest vacancy levels were industrial engineering (13 percent unfilled) and computer science and computer engineering (16 percent).[11]

There is a high proportion of faculty with tenure in universities and colleges, and this proportion is increasing. At the beginning of the 1978/79 academic year, about two-thirds of the full-time S/E faculty at universities and 4-year colleges held tenure, another one-fourth were nontenured but in tenure-track positions, and less than one-tenth were in nontenure-track positions.[12] This high tenure rate has been a contributing factor to the declining share of faculty who are recent doctorates—those holding degrees for seven years or less. High tenure rates reduce the number of potential faculty openings. The

[9] National Science Foundation, *Academic Science: Scientists and Engineers, January 1981* (Detailed Statistical Tables) (NSF 82-305) (Washington, D.C., 1982) tables B-2 and B-3.

[10] National Science Foundation, *Academic Science: 1972-81* (NSF 81-326) (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1982), table B-14.

Chart 6. Change in employment of scientists and engineers in educational institutions: 1978-80



1980 employment estimates in educational institutions	
Scientists and engineers	
Total	505,700
Physical scientists	55,900
Mathematical scientists	52,200
Computer specialists	36,600
Environmental scientists	17,000
Engineers	64,500
Life scientists	153,200
Psychologists	49,900
Social scientists	77,400

SOURCE: National Science Foundation; table B-5

[11] National Science Foundation, "Engineering Colleges Report 10% of Faculty Positions Vacant in Fall 1980," *Science Resources Studies Highlights* (NSF 81-322) (Washington, D.C., Nov. 2, 1981), p. 1.

[12] National Science Foundation, "Tenure practices in Universities and 4-year Colleges Affect Faculty Turnover," *Science Resources Studies Highlights* (NSF 81-300) (Washington, D.C., Feb. 23, 1981).

proportion of recent doctorates on the full-time faculty of S/E departments in doctorate-granting institutions fell to 21 percent in 1980, down from 28 percent in 1974.[13]

Although there is no conclusive evidence, there is a widespread belief that the presence of a body of younger doctorates is essential to the continued vitality of research in universities. Efforts to increase the number of recent doctorates in faculty positions, however, are likely to be influenced by the overall financial health of the institutions, trends in enrollment, and alternative employment opportunities.

federal government

In 1980, although fewer than 1 of every 10 scientists and engineers was employed by the Federal Government, it was still the third largest employer of these personnel. Within this sector, about 40 percent were engineers, primarily electrical, mechanical, and civil. The largest number of scientists were in the life sciences.

S/E employment in this sector increased by 5.6 percent, less than the growth recorded in either business or educational institutions. Employment of scientists in this sector increased significantly faster than employment of engineers; between 1978 and 1980, science employment was up 8.3 percent, with over one-half of this increase accounted for by life scientists.

Engineering employment in the Federal Government increased only about 2 percent between 1978 and 1980. This relatively slow growth reflects, among other factors, the inability to recruit and retain engineers because of noncompetitive salaries. In 1980, for example, there was a neglible difference between Federal Government and industry in starting salaries for baccalaureate engineers. However, salaries for those who had received their degrees 12 to 14 years earlier had fallen to 93 percent of those in industry.[14]

labor market indicators

The foregoing discussion has focused on the employment demand for scientists and engineers. Statistics on demand, however, do not indicate whether the current supply is sufficient to meet the needs of the economy. No single statistic can provide a basis for measuring surpluses and shortages of scientists and engineers in particular fields, but some statistics, when examined together, allow inferences about the condition of the S/E labor market. Market indicators reveal shortages of engineers and computer specialists and more than adequate supplies of environmental, physical, and social scientists and psychologists.

the s/e labor force

The S/E labor force includes scientists and engineers who are employed, either in or out of science and engineering, and those who are unemployed and seeking employment (table 2). The labor force is a measure of those who are economically active and thus directly available to carry out national efforts in science and technology.

Table 2. Science/engineering labor force: 1976-80

[In thousands]

Year	Labor force	Total employed	Unemployed
1976	2369.0	2324.5	44.5
1978	2671.0	2643.3	27.6
1980	2906.0	2873.7	32.3

Source: National Science Foundation; tables B-1 and B-3

Scientists and engineers continued to display a strong attachment to the labor force in 1980, with 2.9 million (93 percent) of the S/E population participating. This rate is higher than the rate of 87 percent for the general population completing 4 or more years of college. The difference in participation rates cannot be accounted for by differences in the sex composition of these groups. When further stratified by sex, S/E men have slightly higher rates than S/E women (94 percent versus 90 percent), and S/E women have considerably higher rates than women in the total civilian labor force (90 percent versus 52 percent).[15]

unemployment rates

The unemployment rate is a standard measure of labor market conditions. Unemployment rates for scientists and engineers remained at about 1 percent between 1978 and 1980, while the overall U.S. unemployment rate increased from about 6 percent to 7 percent.[16] This recent stability in S/E unemployment rates is in contrast to the decline that occurred between 1976 and 1978, when the unemployment rate fell from 1.9 percent.

There was some variation among fields in the 1980 unemployment rates for scientists and engineers (chart 7). Regardless of field, however, S/E unemployment rates remained considerably below those for the entire labor force. In 1980, for example, the highest unemployment rate was posted by environmental scientists, although this 2.5-percent unemployment rate was still considerably below the 7-percent rate for the entire U.S. labor force.

s/e utilization rates

Unemployment rates alone are not necessarily a good indicator of market conditions for scientists and engineers, since they do not indicate how successful those with S/E training are in finding jobs in science and engineering. Thus, the S/E utilization rate has been developed to show the degree to which scientists and engineers in the labor force hold S/E jobs. In 1980, the S/E utilization rate was 88 percent, down slightly from 1978 (90 percent) and 1976 (89 percent). The rate varied somewhat between engineers and scientists and among science fields (chart 8), and between 1978 and 1980 the rates for major fields changed in a narrow range. The only field showing an increase was the social sciences.

Although the S/E utilization rate is a good indicator of market conditions, some

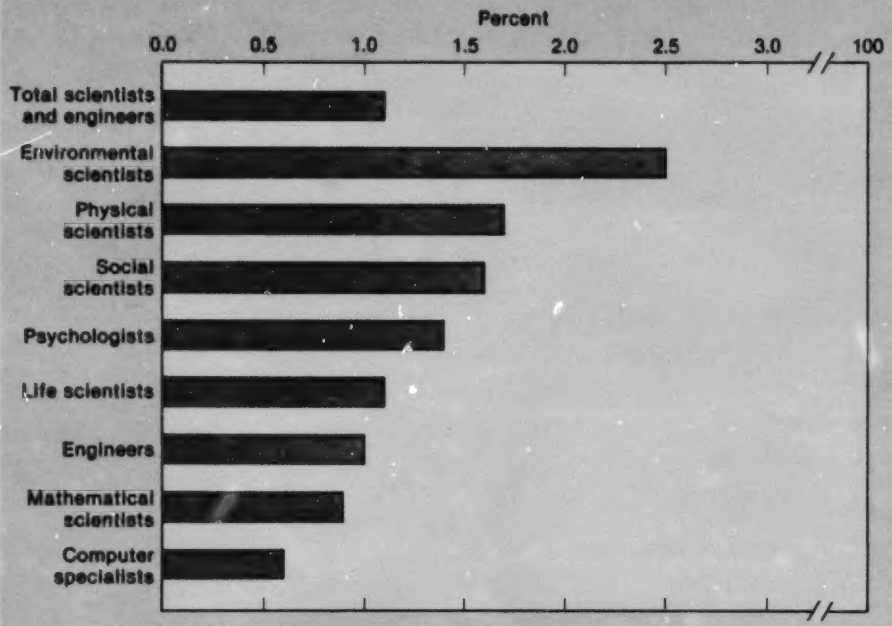
[13] National Science Foundation, "Science and Engineering Faculty With Recent Doctorates Fell to One-Fifth of Total in 1980," *Science Resources Studies Highlights* (NSF 81-318) (Washington, D.C., Oct. 30, 1981).

[14] Engineering Manpower Commission, American Association of Engineering Societies, *Professional Income of Engineers, 1980* (New York, N.Y., November 1980), pp. 21 and 67.

[15] Council of Economic Advisers, Executive Office of the President, *Economic Report of the President, 1981* (Washington, D.C., Supt. of Documents, U.S. Government Printing Office), p. 266.

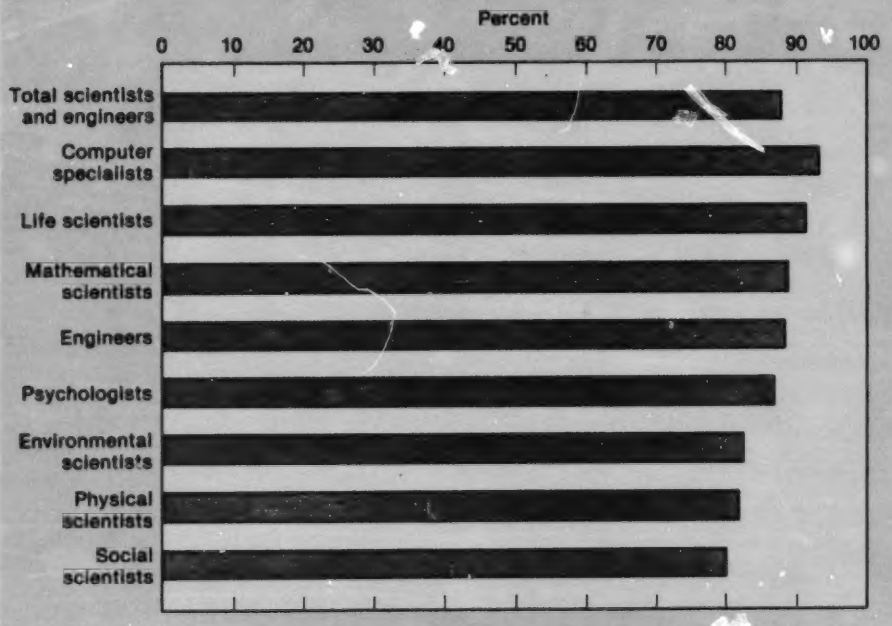
[16] *Ibid.*, p. 269.

Chart 7. Unemployment rates of scientists and engineers: 1980



SOURCE: National Science Foundation; tables B-1 and B-3

Chart 8. Science/engineering utilization rates: 1980



SOURCE: National Science Foundation; tables B-1 and B-3

caution must be exercised in interpretation. Some who leave S/E jobs move to managerial positions that do not involve S/E activities. Others work outside of S/E activities for a variety of reasons not necessarily related to labor market conditions—for example, strong location preference. Relatively few (about 10 percent) take non-S/E jobs because they cannot find S/E jobs. Thus, small declines in the S/E utilization rates do not necessarily imply weak or declining markets.

other indicators

Another indicator of labor market conditions for scientists and engineers is the certification of foreigners to fill positions for which employers have demonstrated that U.S. residents are not available. In 1978, about 2,100 foreigners were certified by the U.S. Labor Department to fill S/E positions. By 1980, these certifications more than doubled to almost 4,600.[17] Much of the growth was for systems analysts (from about 50 to nearly 400) and for electrical and computer engineers (from about 550 to over 1,300). During the 1978-80 period, there was a substantial rise in certification for industrial, mechanical, civil, and aeronautical engineers and for geologists. Most of these increases continued through 1981.

Still another indicator of labor market conditions is the College Placement Council's reports of college recruiting activity at the bachelor's degree level. According to these reports, 63 percent of all offers to bachelor's-degree candidates in 1980 were made to engineering students. This percentage is up from 58 percent of total offers in 1978 and 50 percent in 1976.[18]

Scientific disciplines accounted for 8 percent of the recruiting volume in 1980.[19] Computer sciences continued to dominate this category, comprising almost one-half of the offers reported among natural science fields. Within engineering, the fields receiving the highest number of offers were electrical (including computer), mechanical, and chemical engineering.

Increases in engineering salary offers ranged from 16 percent to 24 percent between 1978 and 1980. Computer science graduates received offers averaging $1,558 per month, 23 percent above 1978 levels.

[17] U.S. Department of Labor, unpublished data.

[18] College Placement Council, *CPC Salary Survey*, Formal Report No. 3 (Bethlehem, Pa., July 1981), p. 2.

[19] *Ibid.* (Excluding social sciences and psychology).

Petroleum engineering continued to command the highest salary offers, with an average monthly salary offer of $1,987, 20 percent above the 1978 average.

Data for 1981 show a continuation of the trends since 1978. Engineering offers accounted for 65 percent of all offers at the bachelor's level, and petroleum engineers again had the highest salary offers ($2,221 per month). Although computer science graduates received the most offers among graduates in the science fields, they did not receive the highest salary offers. The highest offers in science went to "other physical science and earth science" graduates ($1,846), which were up almost 50 percent from 1978 and 20 percent from 1980.

The employment status of recent S/E graduates is another indicator of labor market conditions. In 1980, the S/E utilization rate was 51 percent for persons who received S/E bachelor's degrees one to two years earlier.[20] Persons with degrees in engineering and computer fields showed a significantly greater tendency to obtain jobs in S/E fields than those with degrees in the social sciences (chart 9). The lower rates in some fields, however, may reflect entry-level job requirements for advanced degrees.

The adequacy of recent S/E degree production to meet employment demand can be shown by the ratio of employment (classified by field of employment) to the labor force (classified by field of degree). Chart 10 shows the ratio of S/E bachelor's, master's, and doctorate recipients employed in a field relative to the number of graduates in that field who entered the labor force. A ratio of 1.0 indicates a balanced supply/demand condition; ratios of less than 1.0 suggest relative excess supply and those of more than 1.0 show relative excess demand.

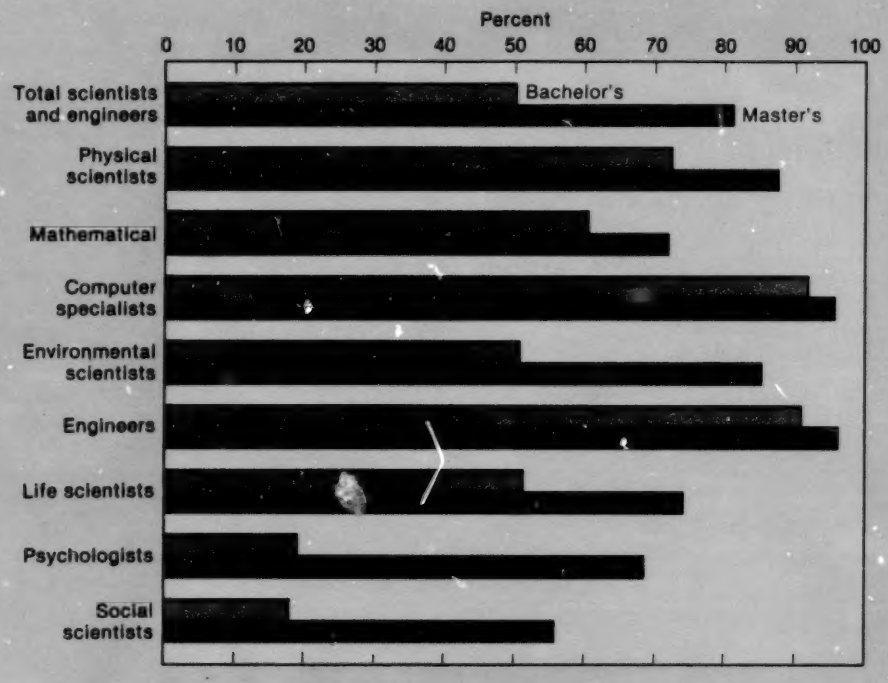
These data indicate there is a relative supply/demand balance in engineering and chemistry and an excess supply in most other science fields except computer specialties. (The index for engineering should be interpreted with some caution, however, since the nature of engineering jobs may make it difficult for those trained in other fields to work as engineers.) The data also suggest that the relative imbalances are somewhat smaller at the master's and doctorate levels, although the strong demand for computer specialists is also evident among advanced degree recipients.

The High Technology Recruitment Index (HTRI) is also an indicator of market conditions for scientists and engineers. The HTRI measures the amount of advertising space devoted to recruiting scientists and engineers. Starting in 1970, the index measured 60 (chart 11). After a drop in 1971, the index steadily increased until 1974, when it dropped sharply. In 1975, it began another steady increase. Demand may have peaked in 1979, at a 10-year high of [illegible], in 1981, the index dropped to 135.[21]

[20] Excluding full-time graduate students.

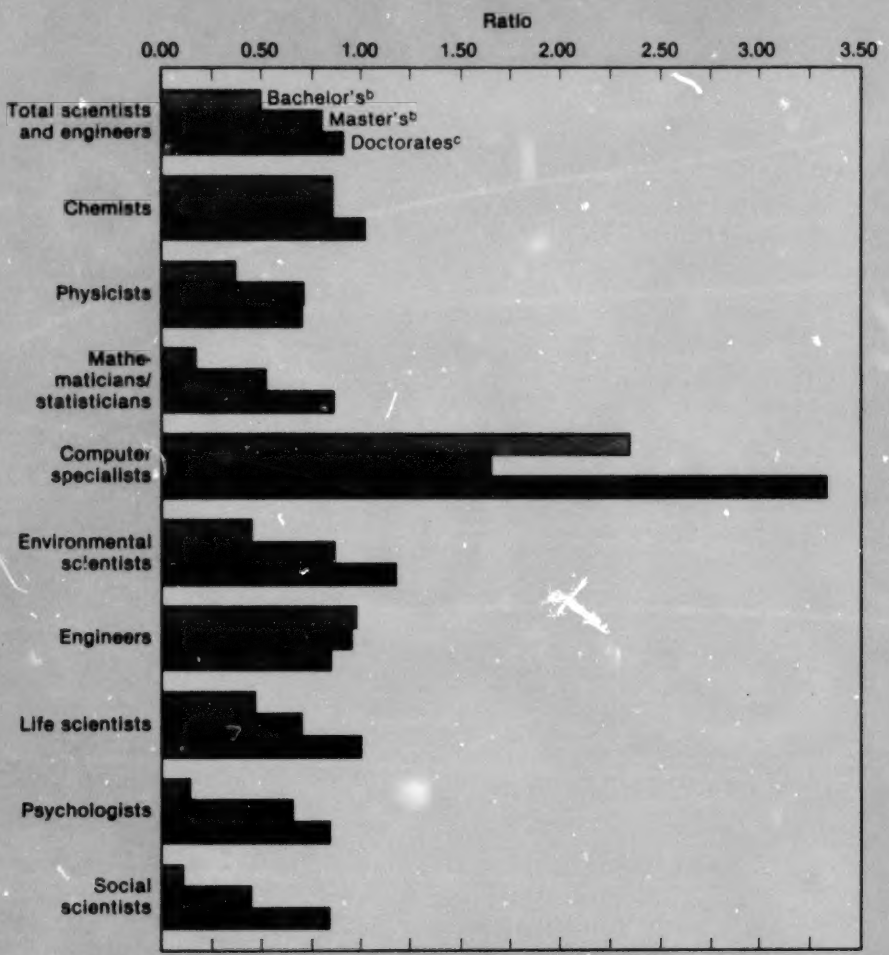
[21] Deutsch, Shea and Evans, *High Technology Recruitment Index Year End Review and Forecast* (New York, N.Y.: Deutsch, Shea and Evans, Inc., 1982).

Chart 9. Science/engineering (S/E) utilization rates of 1978 S/E degree recipients by field of degree: 1980



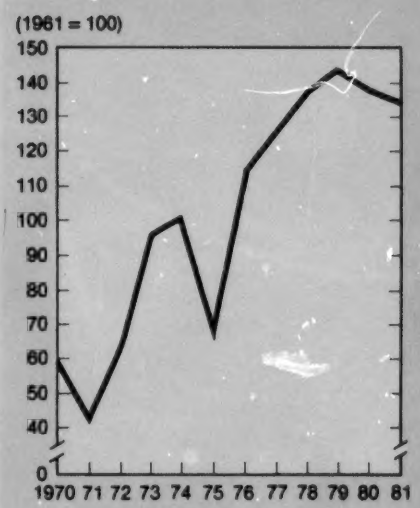
SOURCE: National Science Foundation, unpublished data

Chart 10. Ratio of recent science/engineering degree recipients[a] employed in field relative to graduates in field who entered the labor force



[a]Excludes full-time graduate students and those holding postdoctoral appointments.
[b]1978 graduates in 1980.
[c]1977 graduates in 1979.
SOURCE: National Science Foundation, unpublished data

Chart 11. Deutsch, Shea and Evans high technology recruitment index: 1970-81



SOURCE: Deutsch, Shea and Evans

projected supply and utilization

Projections prepared in 1980 by the National Science Foundation with the cooperation of the Bureau of Labor Statistics indicate that by 1990 the supply of scientists and engineers at all degree levels will likely be more than adequate to meet demand in all fields except the computer professions, statistics, and some fields of engineering.[22] These projections are summarized in table 3.

In general, new science graduates will probably exceed the number able to find jobs in the disciplines in which they were trained. This implies that many science graduates will take employment in fields not directly related to science and engineering. Also implied is a continued upgrading of the level of training of the technical labor force. Thus, those with advanced degrees would fill jobs once held by those with the baccalaureate, and baccalaureates would fill jobs once held by those with less training, often in positions unrelated to science or engineering.

These projections indicate that for engineers with bachelor's or master's degrees, the labor market by 1990 should be less tight than at any time since the early seventies. Employers may have difficulty, however, in finding graduates in some fields of engineering (e.g., aeronautical and industrial), particularly if defense programs expand more rapidly than assumed in the projections.

[22]See National Science Foundation and Department of Education, *Science and Engineering Education for the 1980's and Beyond* (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, October 1980), for a discussion of the specific assumptions underlying the projects and the impact on supply/demand conditions of alternative assumptions. The projections outlined in this report assume a decline in unemployment to 4.5 percent by 1990 and an annual increase in labor productivity to 2.4 percent by 1985-90 above the 1980 rate. The assumptions do not include (a) a sharply augmented defense budget, (b) large-scale development of synthetic fuels, or (c) a balanced Federal budget.

Table 3. Projected market for scientists and engineers in 1990 by field and level of training

[All scenarios]

Field	Baccalaureates and master's	Doctorates
Physical sciences	Adequate	Adequate
Atmospheric	Balance	
Chemical	Adequate	
Geological	Adequate	
Physic astronomy	Adequate	
Engineering	Adequate	Uncertain
Aeronautical	Balance-Shortage[1]	(Possible shortages some fields)
Chemical	Adequate	
Civil	Adequate	
Electrical	Adequate	
Industrial	Shortage	
Mechanical	Adequate	
Metallurgical	Adequate	
Mining	Adequate	
Petroleum	Adequate	
Other	Adequate	
Mathematical sciences	Adequate	Adequate
Mathematicians	Adequate	
Statisticians	Shortage	
Computer professions	Shortage	Shortage
Life sciences	Adequate	Adequate
Agricultural	Adequate	Adequate
Biological	Adequate	Adequate
Social sciences	Adequate	Adequate
Psychologists	Adequate	
Other	Adequate	
All fields	Adequate	Adequate

[1]Shortage under expanded defense spending assumption only.

NOTE: "Adequate" indicates the projected supply exceeds projected demand. "Balance" indicates that projected supply is close to projected demand. "Shortage" indicates that projected supply is less than projected demand. "Uncertain" is used for doctoral engineers because NSF projects an adequate supply in 1990 whereas BLS projects a shortage in 1985.

SOURCES: National Science Foundation and Department of Education

doctoral scientists and engineers

Doctorate holders are a particularly critical component of the human resources devoted to science and technology. Over one-half are employed in educational institutions, where they are involved in training future scientists and engineers and in performing basic research to expand scientific and technical knowledge. Regardless of sector of employment, almost one-half are primarily engaged in R&D activities that can result in innovations that improve productivity.[23]

employment

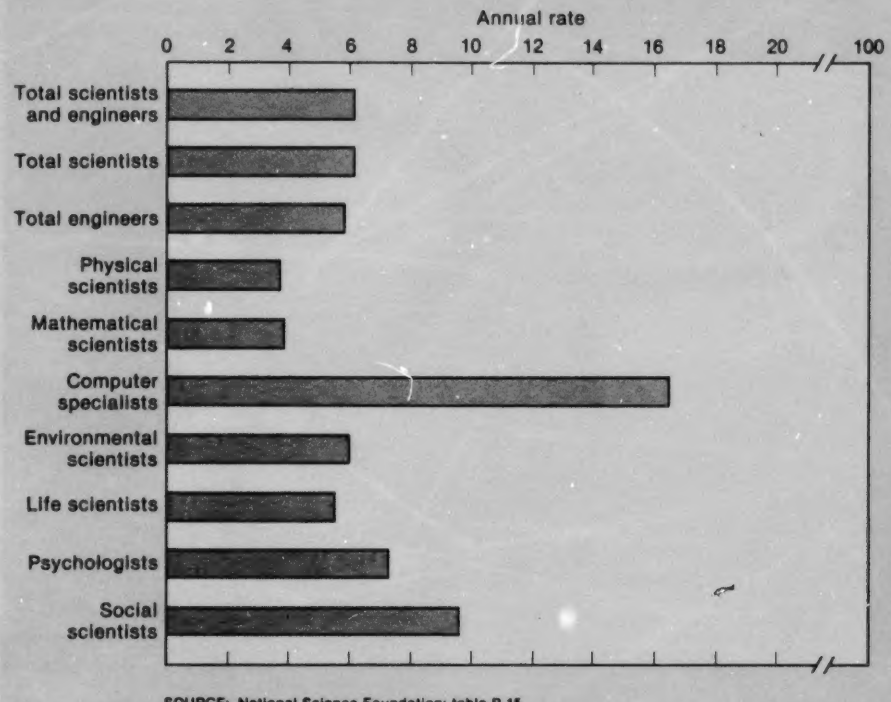
Employment of those holding S/E doctorates showed strong gains during the seventies. In 1979, almost 314,000 doctoral scientists and engineers were employed in either S/E or non-S/E activity. Between 1973 and 1979, employment in S/E jobs increased at an annual rate of 5.5 percent to 277,000, slower than the 11-percent annual rate registered by those in non-S/E activities over the same period. Although small (9 percent in 1979), an increasing share of doctoral scientists and engineers have been working in jobs outside their own or related fields. Most do so for voluntary reasons, such as preference for non-S/E jobs, promotional opportunities, better pay, or locational preference. Only about 10 percent of those doctorates holding jobs outside of science and engineering indicated that they were so employed because they believed S/E jobs were not available.

Employment of doctoral scientists and engineers has been increasing more rapidly than employment of scientists and engineers at all degree levels. As a result, the education level of the overall S/E work force has been rising steadily. Currently, about 11 percent of all scientists and engineers hold doctorates, up from about 9 percent in the early seventies.

In 1979, scientists continued to outnumber engineers by almost 8 to 1 in the doctoral work force. Through the mid- to late seventies, employment of doctoral engineers increased at a more rapid annual rate than engineers at all degree levels (6 percent versus 4 percent). Growth varied considerably among science fields (chart 12), with below-average annual rates in

[23] The status of U.S. doctorates is surveyed on a biennial basis. 1979 data were the latest available when this manuscript was prepared.

Chart 12. Annual rates of employment growth for doctoral scientsts and engineers by field: 1973-79



SOURCE: National Science Foundation; table B-15

the physical and mathematical sciences. The fastest growing employment field among doctoral level scientists and engineers was computer specialties; between 1973 and 1979, employment grew at an annual rate of about 17 percent.

Differences in growth rates have altered the field distribution of doctoral scientists and engineers. The proportions in the social sciences (including psychology) and computer specialties have increased while the proportion in physical sciences has declined (chart 13).

doctoral science and technology activities

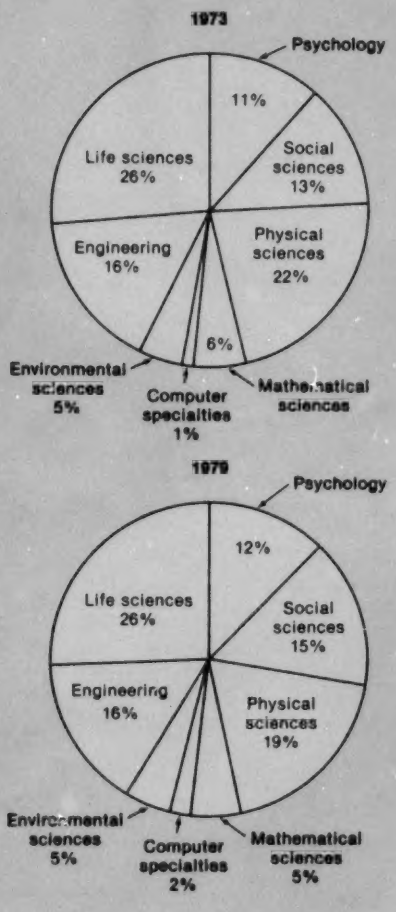
Employment of S/E doctorates continues to shift to the industrial sector from educational institutions and the Federal Government. Annual employment growth in business/industry was substantially greater than overall employment growth (7.6 percent versus 6.1 percent), with employment in educational institutions and the Federal Government growing about 5 percent per year between 1973 and 1979. Nonetheless, educational institutions continued as the major employer of over one-half the doctoral scientists and engineers (chart 14).

The nature of science and technology activities differs considerably among economic sectors. Development activities are primarily carried out in the industrial sector, whereas basic research and teaching are concentrated in universities and colleges.

Between 1973 and 1979, the proportion of doctoral scientists and engineers reporting research and development as their primary activity remained constant at 32 percent, while the proportion in management increased slightly, from 21 percent to 23 percent. Conversely, the proportion reporting teaching as their primary work fell sharply, from 36 percent to 29 percent (chart 15).

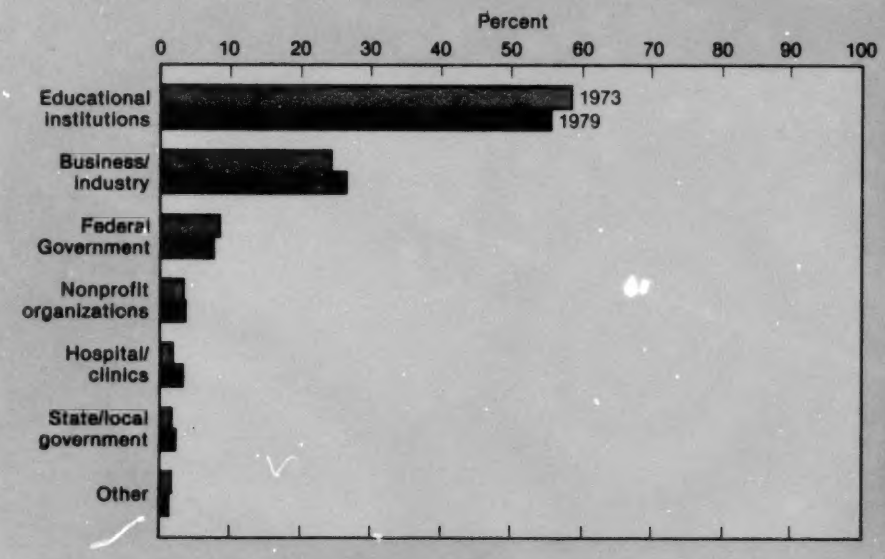
The decline in the proportion of doctorates reporting teaching as their primary activity is a dramatic example of the effects of both inter- and intra-sectoral shifts on work activities. The decline was the result of two factors: (a) the sectoral shift from universities to industry and (b) the rapidly increasing number of doctorates in universities who report basic and applied research, rather than teaching, as their major activity.

Chart 13. Employed doctoral scientists and engineers by field and year



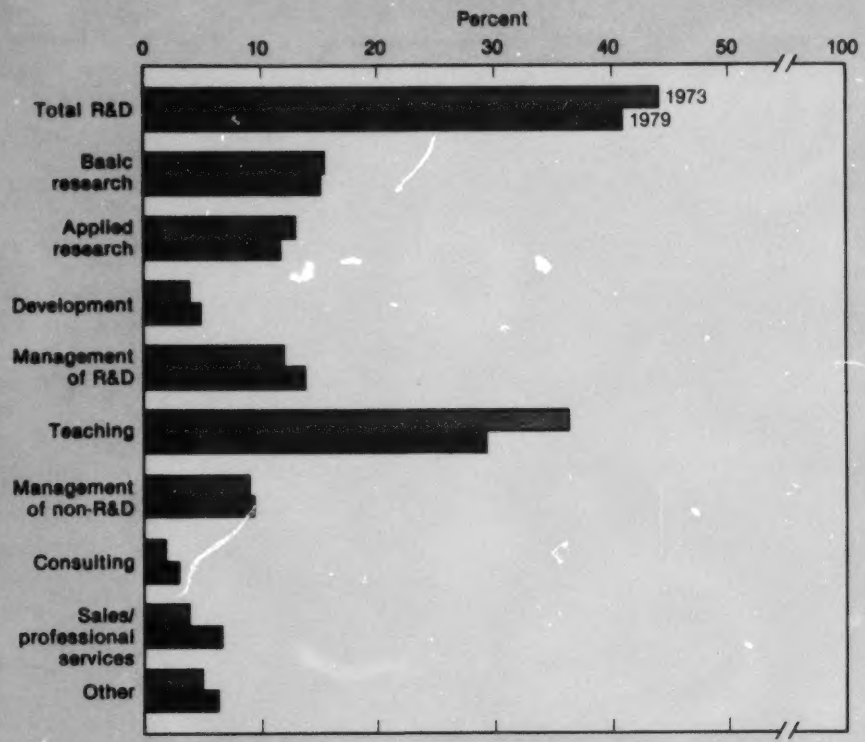
SOURCE: National Science Foundation; table B-15

Chart 14. Doctoral scientists and engineers by sector of employment: 1973 and 1979



SOURCE: National Science Foundation; table B-15

Chart 15. Doctoral scientists and engineers by primary work activity: 1973 and 1979



SOURCE: National Science Foundation; table B-15

Academic Employment. In 1979, universities and colleges employed 55 percent of the doctoral scientists and engineers, down from 59 percent in 1973. Almost three-fifths of the scientists but only a third of the engineers were employed in this sector. Seventy percent of these scientists were either psychologists or life or social scientists.

Within educational institutions, there has been a sharp decline in the proportion of doctorates reporting teaching as their primary work activity. In 1973, over three-fifths reported teaching, but by 1979 only slightly more than one half reported their primary activity as teaching (chart 16). Correspondingly, since 1973, there has been an increase of over 50 percent in the number of Ph.D. scientists and engineers reporting research and development, especially basic and applied research, as their primary work. This increase in research activities is reflected in the increase of university expenditures for research; between 1973 and 1979, such expenditures rose 22 percent (in constant dollars).[24]

Industrial Employment. The proportion of Ph.D. scientists and engineers employed in the industrial sector has risen from 24 percent in 1973 to 26 percent in 1979. The most significant component in the shift to this sector was the increase in employment of engineers. Although their growth rate in this sector was lower than the industrial growth in most other fields, engineers accounted for over 30 percent of the increase in industrial employment of Ph.D. scientists and engineers between 1973 and 1979. Over one-half of the employed doctoral engineers were employed in industry, as were over two-fifths of the physical scientists.

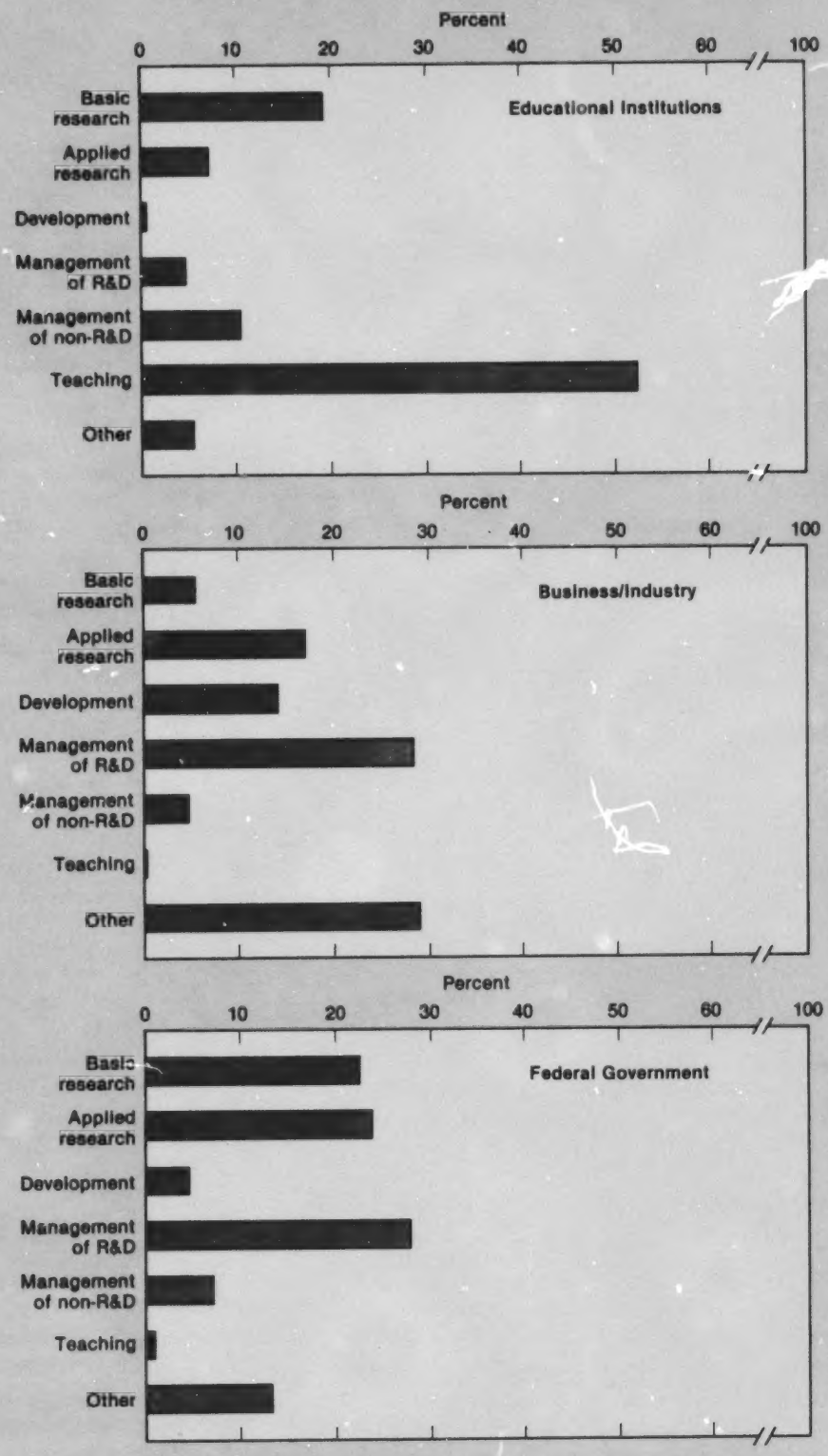
The proportions of Ph.D. scientists and engineers who were industrially employed increased in all other fields, with the greatest increases in the social sciences (including psychology) and the computer specialties. This shift to industrial employment is most notable among new doctorates. Of those earning their doctorates in 1973, the proportion finding initial employment in industry was 14 percent; by 1979, this share had risen to 17 percent.[25]

Research and development continued to be the most frequently reported primary work activity of industrially employed Ph.D. scientists and engineers (chart 16). However, there has been a significant decline in this proportion since 1977. Between 1973 and 1977, the number of S/E doctorates working primarily in research and development rose almost 32 percent and accounted for approximately 44 percent of all doctorates in industry. During the 2-year period after 1977, the number of doctoral scientists and engineers primarily engaged in research and development declined slightly (almost 2 percent), and their proportion fell to 37 percent. This decrease was the result of a decline in those working primarily in basic and applied research.

[24] National Science Foundation, *National Patterns of Science and Technology Resources 1981* (NSF 81-311), (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office, 1981), pp. 26-27.

[25] Commission on Human Resources, National Research Council, *Summary Report, 1973 Doctorate Recipients From United States Universities* and *Summary Report, 1979 Doctorate Recipients From United States Universities* (Washington, D.C., annual series).

Chart 16. Doctoral scientists and engineers by selected sector and primary work activity: 1979



SOURCE: National Science Foundation; table B-16

Development continued to be reported as the primary work activity of more industrially employed doctorates than of those in any other sector—almost 2 out of 5 of those working in research and development in industry reported their primary activity as development compared to less than 1 in 10 of those in all other sectors.

Rapidly increasing activities include management of research and development (up 50 percent between 1977 and 1979) and sales and professional services (up over 50 percent between 1977 and 1979). By 1979, R&D management was the primary activity of 29 percent of the industrially employed doctoral scientists and engineers; sales and professional services represented 12 percent.

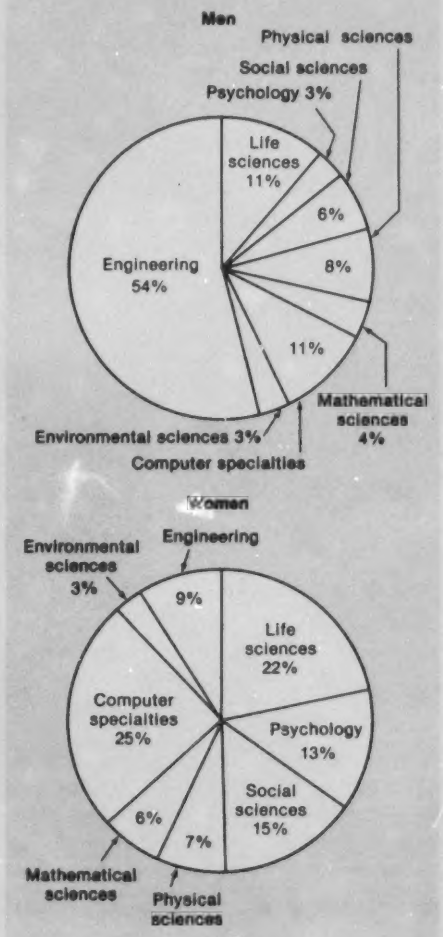
Federal Government Employment. About the same fraction of scientists (8 percent) and engineers (7 percent) with doctorates were employed by the Federal Government. Of these, over one-half were in the life or physical sciences; life scientists alone accounted for 31 percent. Over one-half the doctoral scientists and engineers employed by the Federal Government reported research and development as their primary work activity (chart 16). This represents a significantly larger fraction than in the other two major sectors: business/industry (37 percent) and educational institutions (27 percent).

women and minorities

women scientists and engineers

Employment of women scientists and engineers increased more than 5 times faster than employment of men between 1978 and 1980 (32 percent versus 6 percent). Despite this rapid increase, women are still underrepresented in science and engineering. The approximately 360,000 women scientists and engineers in 1980 represented about 12.5 percent of all employed scientists and engineers, up from 10.4 percent in 1978 and 9.2 percent in 1976. Over one-half of the increase in the employment of women took place in three major fields—computer specialties, engineering, and mathematical sciences. Reflecting the favorable employment opportunities for all engineers, the number of employed women engineers increased by over 60 percent to almost 33,000 as women with training in science fields moved to engineering occupations. Although women represented less than 2.5 percent of all employed engineers in 1980 (chart 17), the number of women earning bachelor's degrees in engineering almost doubled between 1978 and 1980.

Chart 17. Employed scientists and engineers by sex and field: 1980



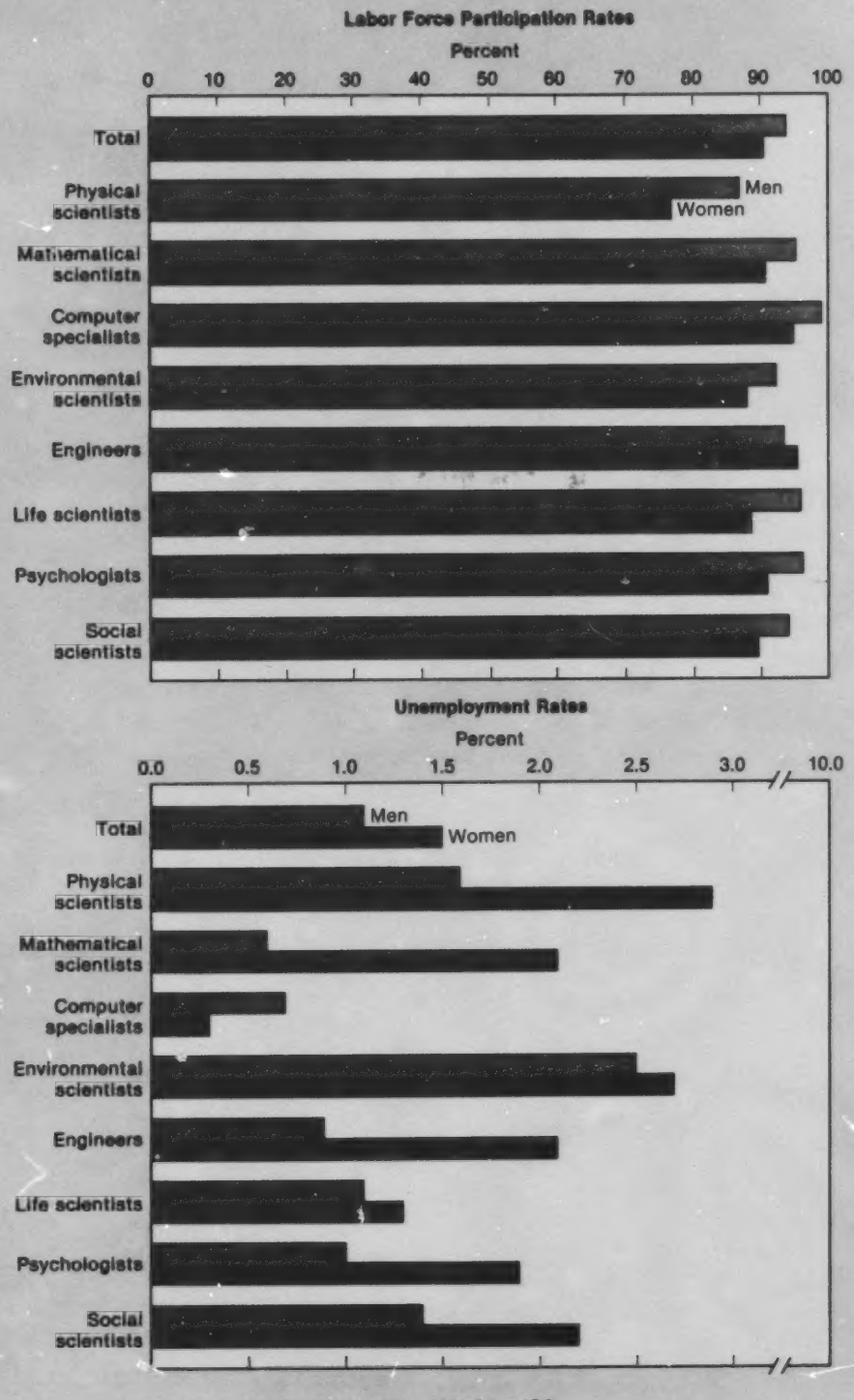
SOURCE: National Science Foundation; table B-3

Despite their relative employment success, women scientists and engineers continued to experience slightly higher unemployment rates than men in 1980 (1.5 percent versus 1.1 percent) (chart 18). However, unemployment rates for women scientists and engineers were substantially lower than the rate for all women in professional and technical fields (7.4 percent in 1980). Coupled with their high labor-force participation (90 percent compared with 73 percent for all women who had completed four or more years of college), the relatively low unemployment rate for S/E women indicates that the skills they have acquired are available and uitilized in the labor market. Women scientists and engineers, however, are slightly more likely than men to be working in non-S/E jobs. In 1980, about 13 percent of the employed S/E women were in non-S/E jobs; for men, the comparable figure was almost 11 percent.

Among doctoral scientists and engineers, employment of women has been increasing twice as rapidly as employment of men. Between 1973 and 1979, employment of women almost doubled, rising from 17,000 to 33,000. In comparison, employment of men increased by about 38 percent, from 204,000 to 280,000. The approximately 33,000 employed women in 1979 represented about 11 percent of the total, up from 8 percent in 1973. Women Ph.D. scientists and engineers are concentrated in the life and social sciences, including psychology (chart 19); men are most likely to be in the life or physical sciences or engineering. Almost 85 percent of the employment growth for women took place in three major fields—life sciences, social sciences, and psychology. However, the proportions of women in these fields remained relatively constant.

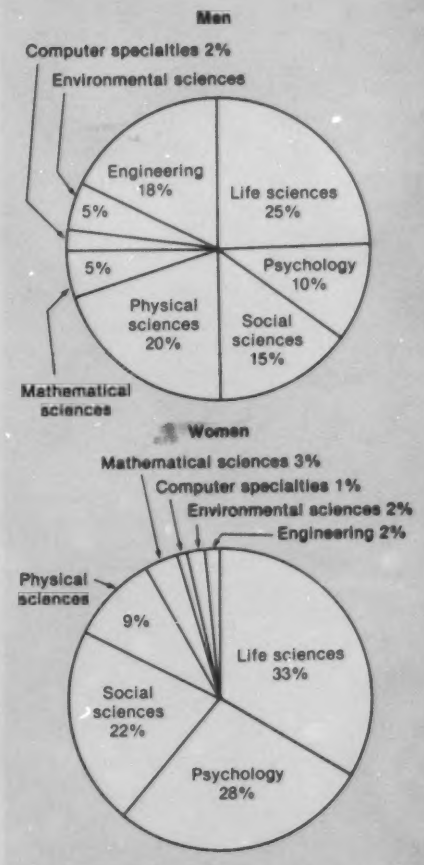
Regardless of sex, more doctorates are employed in educational institutions than in other sectors. However, compared to Ph.D. men, a larger fraction of Ph.D. women are employed by educational institutions and a smaller fraction are employed in industry. In 1979, about two-thirds of the women scientists and engineers with doctorates were in educational institutions, compared to about one-half of the men.

Chart 18. Scientists and engineers by field, labor force participation rates and unemployment rates: 1980



SOURCE: National Science Foundation; tables B-1 and B-3

Chart 19. Employed doctoral scientists and engineers by sex and field: 1979



SOURCE: National Science Foundation; tables B-15 and B-20

While the overall Ph.D. labor market for scientists and engineers with doctorates remained relatively unchanged between 1973 and 1979, market conditions for Ph.D. women improved significantly, although women still lagged behind men (chart 20). The labor force participation rate of women increased from less than 85 percent to over 90 percent, while the rate for men varied between 95 percent and 96 percent. There was also a significant decline in the unemployment rate of women (3.8 percent to 2.7 percent). The unemployment rate for men was 0.7 percent in 1979, down slightly from 0.9 percent in 1973.

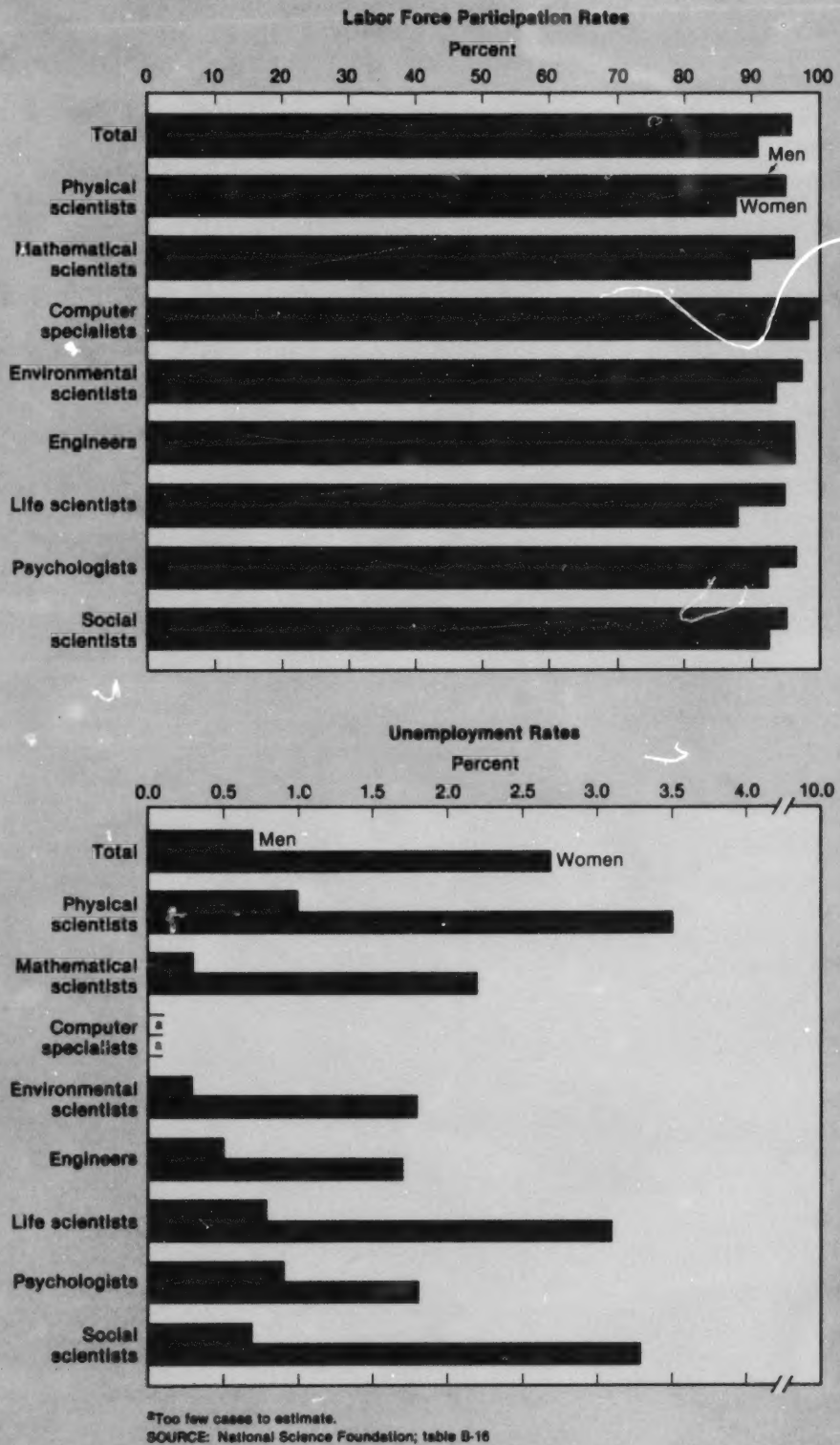
The S/E utilization rates were also lower for Ph.D. women than for men. In 1979, 87 percent of the women worked in science and engineering; the rate for men was 91 percent. The lower utilization rate of women is partly attributable to differences in field distribution by sex; i.e., women are more heavily concentrated in social science and psychology fields that traditionally show lower S/E utilization rates. The S/E utilization rate for women, when standardized for field, rises to almost 89 percent. This indicates that roughly half of the difference in this rate by sex is accounted for by field distribution effects.

minorities

Employment of minority scientists and engineers has increased more rapidly between 1978 and 1980 than employment of whites. Over this period, employment of blacks increased by 17 percent and employment of Asians increased by 11 percent. Employment of white scientists and engineers increased by 8 percent over the same 1978-80 period. The approximately 55,000 black scientists and engineers in 1980 represented about 2 percent of the total, while the 76,000 Asians represented about 2.5 percent of the total. Blacks are clearly underrepresented in S/E jobs. Asians, who make up a smaller percentage of the population, are not. In 1980, blacks and other minorities represented about 9 percent of all professional and related workers. Of these minorities, over three-fourths were black.

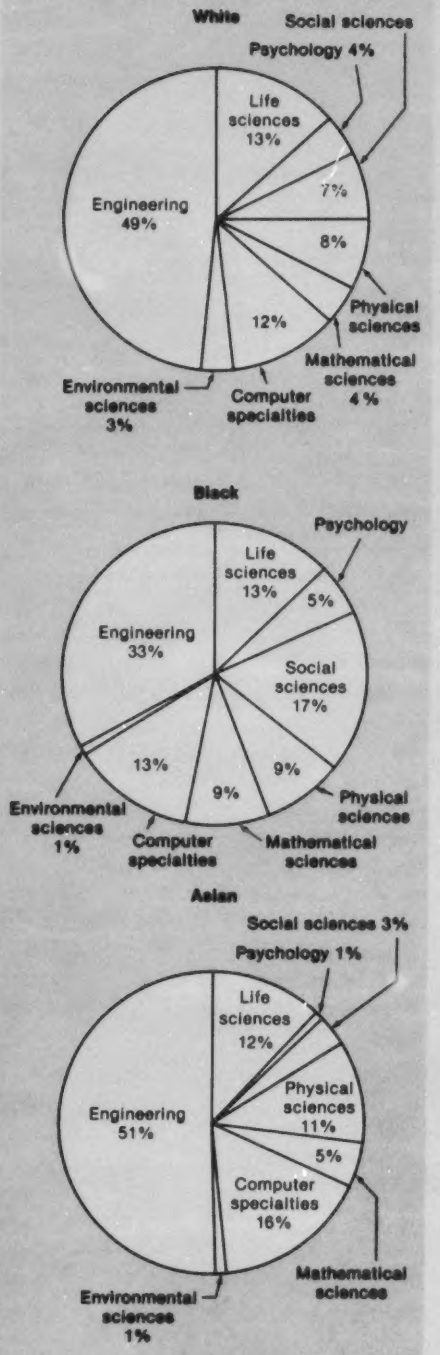
There is some variation in unemployment rates by race (chart 22). The 1980 unemployment rate for black scientists and engineers was 2.1 percent, well below the

Chart 20. Doctoral scientists and engineers by field, sex, labor force participation rates and unemployment rates: 1979



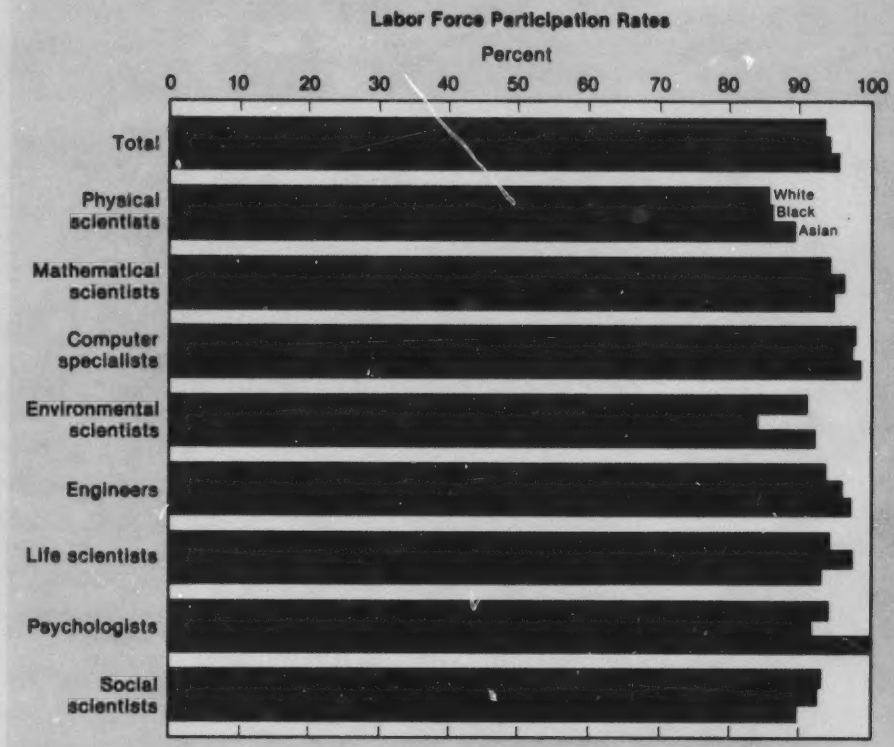
[a]Too few cases to estimate.
SOURCE: National Science Foundation; table B-16

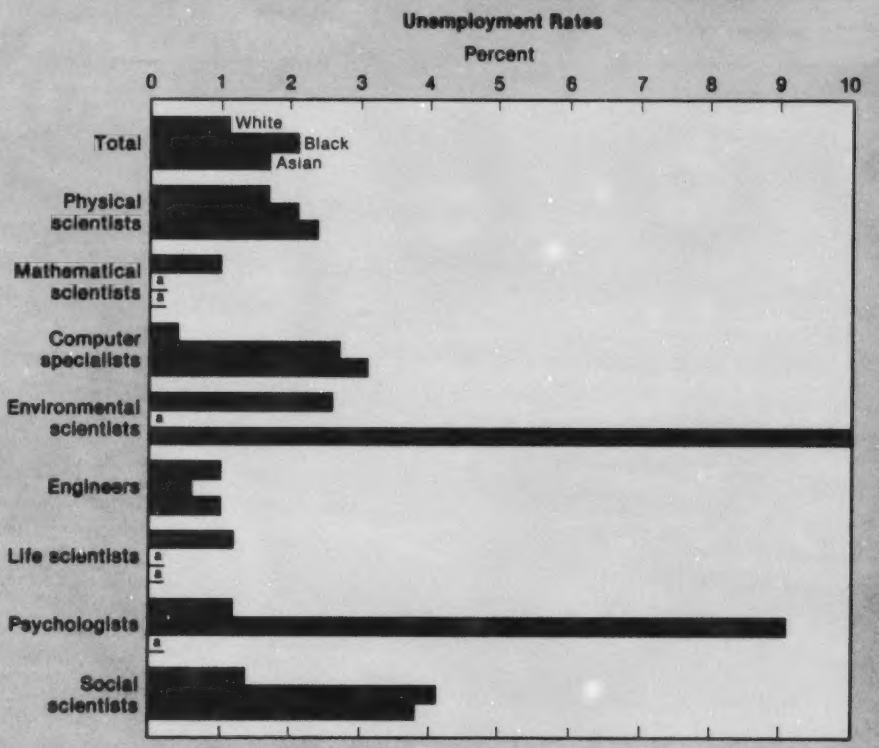
Chart 21. Employed scientists and engineers by race and field: 1980



SOURCE: National Science Foundation

Chart 22. Scientists and engineers by field, race, labor force participation rates, and unemployment rates: 1980





[a]Too few cases to estimate.
SOURCE: National Science Foundation; tables B-10 and B-11

rate for all blacks with four or more years of college (4.1 percent) but above that for white scientists and engineers (1.1 percent). Over one-half of the unemployed black scientists and engineers were either psychologists or social scientists. There was relatively little unmeployment among black natural scientists, engineers, and computer specialists.

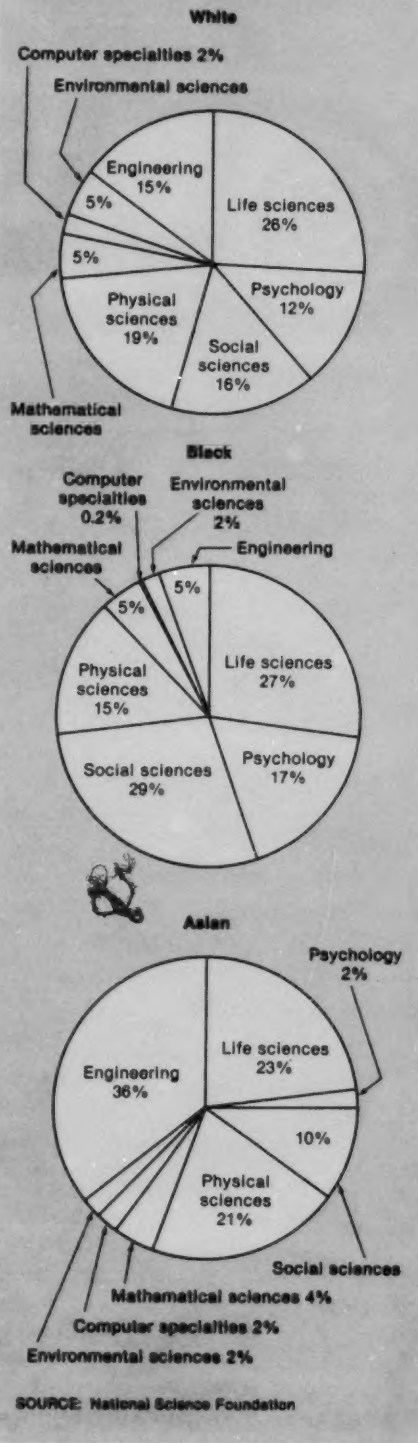
Blacks are slightly more likely than whites to hold jobs outside science or engineering. In 1980, 85 percent of the employed black scientists and engineers were working in S/E jobs; for whites, the comparable figure was 89 percent. Asian scientists and engineers are less likely than either whites or blacks to be working outside of science or engineering; almost 94 percent of the employed Asian scientists and engineers were working in S/E jobs. Differences between the races in the proportion holding S/E jobs largely reflect differences in field concentration.

Employment of both black and Asian Ph.D. scientists and engineers increased more rapidly than that for whites. Between 1973 and 1979, Asian employment more than doubled (from 9,100 to 21,000); among black Ph.D. scientists and engineers, employment increased by almost two-thirds, from 2,100 to 3,400. For whites, the increase was about 38 percent, from 200,000 to 277,000. Despite this rapid employment growth, black doctorates represented only about 1 percent of all employed doctorates in 1979, up slightly from 1973. The 21,000 employed Asian doctorates represented almost 7 percent of total S/E doctoral employment, up almost twofold from 1973, when their proportion was 4 percent.

Regardless of race, about one-quarter of the S/E doctorates were employed in the life sciences (chart 23). Excluding this field, the racial groups showed significantly different field distributions. A larger proportion of blacks are in the social sciences and psychology, whereas a larger share of Asians are in engineering or physical sciences.

The proportions of both blacks and whites in the social sciences and in psychology increased between 1973 and 1979. For example, the proportion of blacks who were social scientists increased from

Chart 23. Employed doctoral scientists and engineers by field and race: 1979



SOURCE: National Science Foundation

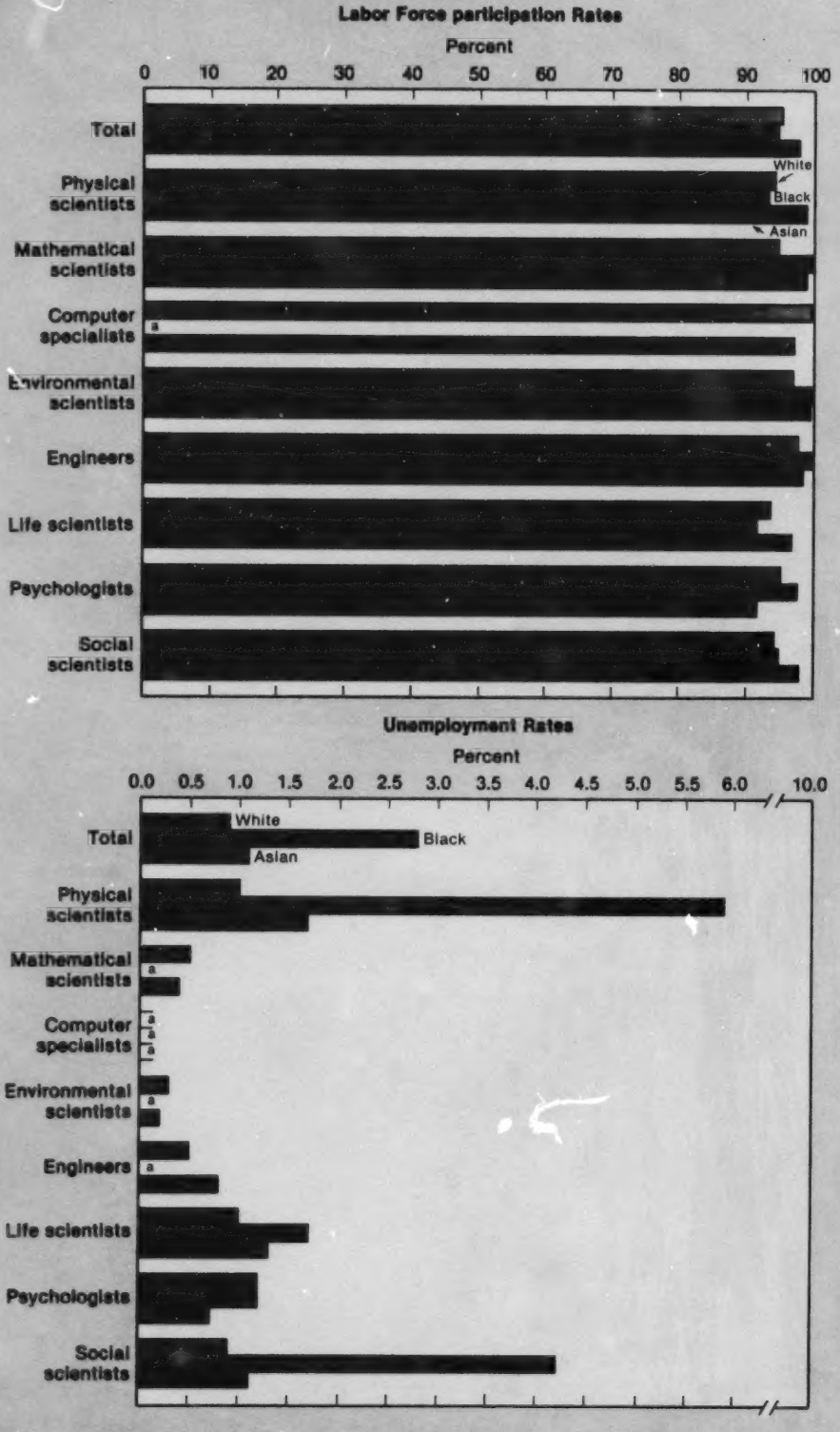
18 percent in 1973 to 29 percent by 1979, while the proportion for whites increased from 13 percent to 16 percent. Among Asians, the field distribution showed relatively little change; slight proportional declines were noted for most science fields, while proportional increases were noted in engineering and computer specialties. In 1979, Asians represented 15 percent of all doctoral-level engineers and 7 percent of all Ph.D. physical scientists.

Between 1973 and 1979, employment of Asian doctoral scientists and engineers in business/industry more than tripled, while employment of blacks was up a third and that of whites was up over two-fifths. The relatively higher proportions of whites and Asians in business/industry results from the heavy concentration of engineers in industry. In comparison with black doctorates, whites and Asians with doctorates are more likely to be engineers than scientists. Over 70 percent of the blacks were in those fields of science where employment opportunities are concentrated in the academic sector—social and life sciences and psychology.

Labor market conditions for black S/E doctorates in 1979 were slightly less favorable than for whites, while conditions for Asians were the most favorable (chart 24). The labor force participation rates of blacks and whites were roughly equal (95 percent). However, the unemployment rate of blacks was substantially higher than that of whites (2.8 percent versus 0.9 percent). This higher rate partly reflects the large numbers of unemployed black doctorates in the physical and social sciences where unemployment rates were 5.9 percent and 4.2 percent, respectively. Among Asians, 98 percent were in the labor force, and slightly over 1 percent were unemployed.

Among the racial groups, blacks with S/E doctorates were more often employed outside of science and engineering than whites or Asians. The S/E utilization rate for black doctorates in 1979 was about 86 percent, compared to 91 percent for whites and over 93 percent for Asians. Again, the field distribution of blacks partially accounts for their lower S/E utilization rate. If the field is standardized, the S/E utilization rate for blacks increases to over 88 percent.

Chart 24. Doctoral scientists and engineers by field, race, labor force participation rates, and unemployment rates: 1979



[a]Too few cases to estimate
SOURCE: National Science Foundation

chapter II

the dynamics of s/e labor markets

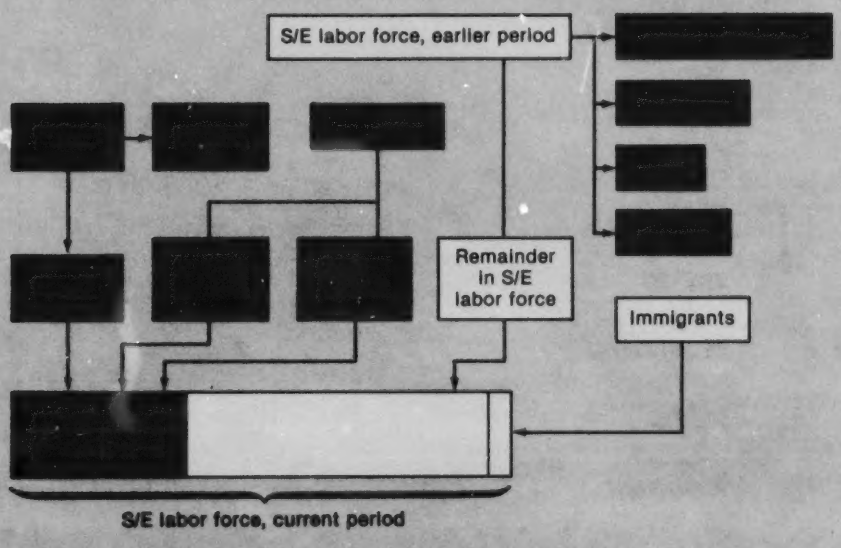
Chart 25 traces the flows within the S/E labor market. These flows act as equilibrating forces in the marketplace by providing the self-correcting mechanisms needed to bring supply and demand into balance. Such flows signal future supply conditions to those making career plans, those responsible for recruiting activities, those engaged in planning academic programs, and those responsible for developing Federal policies on science and technology.

This chapter examines supply flows in and out of science and engineering—new graduate entrants to the labor force, occupational mobility, and separations from the labor force. These form the bulk of the supply changes in the S/E labor market. The flows not dealt with—reentrants of scientists and engineers from outside the labor force, entrants and reentrants from the non-S/E labor force, and immigration and emigration—are relatively small components of total flows and are not expected to assume major roles in the future.

In addition to these flows, the precollege experiences of students—especially their development of mathematics and science skills—are an important precondition for students entering S/E programs at universities and colleges. Thus, information is presented on precollege mathematics and science course-taking and its link with decisions to enter S/E programs.

The chapter then examines degree production in S/E fields and reviews the transition from college and graduate school to the workplace. Mobility patterns of both new entrants and experienced scientists and engineers are explored, and attrition in the S/E labor force is discussed.

Chart 25. Science/engineering (S/E) labor market flows



SOURCE: National Science Foundation

the s/e pipeline: precollege mathematics and science

Student decisions to enter S/E programs at the undergraduate level depend on a number of factors; these include interest and, perhaps more important, an appropriate precollege background. Some level of precollege mathematics and science coursework is needed to gain admission to undergraduate programs in engineering, the sciences, and other quantitative fields. Failure to take this coursework frequently bars an individual from an S/E career. Since mathematics coursework follows a progression, decisions made at the junior high or early high school level to take or not to take specific mathematics courses affect coursework throughout the high school years.

Factors useful in understanding and assessing precollege mathematics and science preparation include curriculum placement, specific coursework, and scores on tests designed to measure mathematics and science abilities and skills. These factors are examined along with the relationship between plans to study science or engineering and scores on the Scholastic Aptitude Test (SAT).

mathematics and science coursework

Decisions not to take coursework in science and mathematics made at the start of high school serve to diminish the supply of potential new entrants to S/E fields, since a strong background in mathematics and science is usually required for access to postsecondary education opportunities in science, engineering, and other quantitative fields. A student's curriculum is particularly important; it largely determines the type of coursework [illegible] and is therefore associated with future educational and career choices. Of the 1980 high school seniors, 39 percent were in academic programs, 37 percent were in general programs, and 24 percent were in vocational programs.[26] Since 1972, the proportion of students in academic programs (a major source of future S/E students) declined by about 4 percentage points, while the proportion in general programs increased by a like amount.

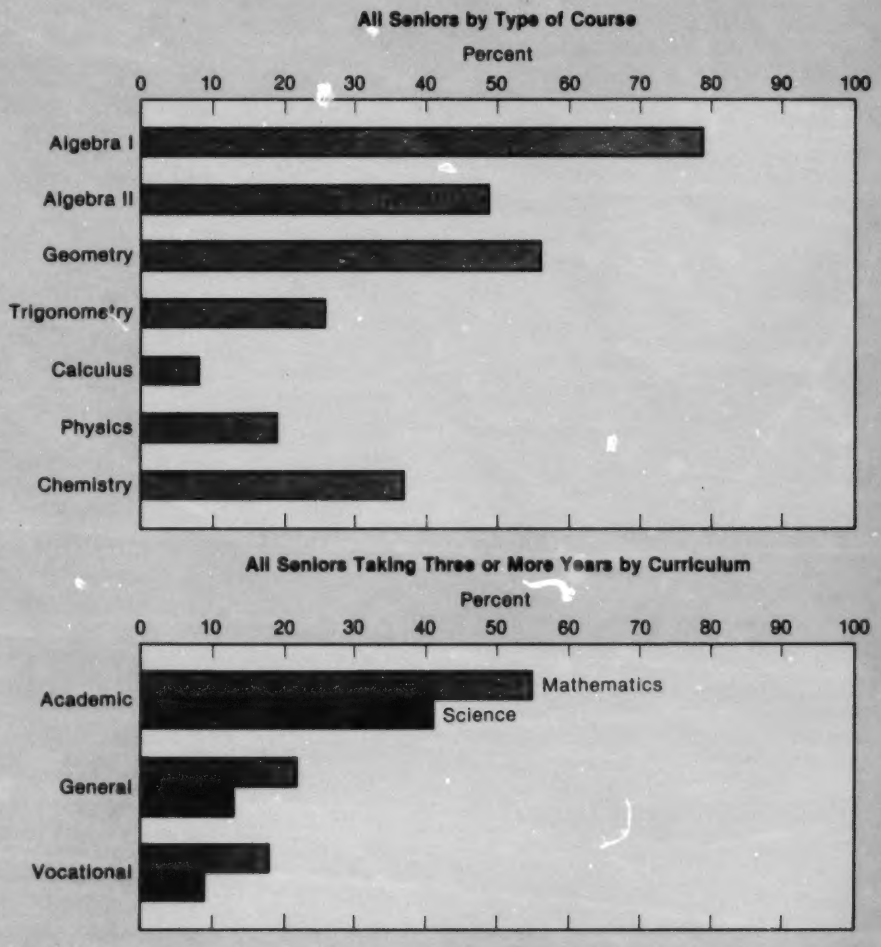
Students in academic programs generally take more coursework in mathematics and science than students in either general or vocational programs (chart 26). For example, 55 percent of the seniors in academic programs in 1980 had taken three or more years of mathematics coursework, compared with only 18 percent of those in vocational programs. Similarly, 41 percent of the seniors in academic programs, but only 9 percent of those in vocational programs, reported taking three or more years of science coursework.[27] While a majority of seniors had taken algebra I (79 percent) and geometry (56 percent), for example, 8 percent had taken calculus (chart 26).

Seniors in academic programs take fewer mathematics courses than college-bound seniors. College-bound seniors—those students who take the SAT and respond to the Student Description Questionnaire (SDQ) administered by the Admissions Testing Program—numbered about 1 million in 1980 (one-third of the 1980 high school graduates) and represented about two-thirds of all graduates who go directly to college. In 1981, about 81 percent of college-bound seniors in academic programs had taken three or more years of math, compared to 55 percent of all 1980 high-school seniors in academic programs. Of these, 29 percent had studied mathe-

[26] National Center for Education Statistics, *High School and Beyond: A National Longitudinal Study for the 1980's* (Washington, D.C., 1981), p. 3.

[27] While this coursework includes both advanced and remedial work, it seems unlikely that remedial work would be taken by those in academic programs. *Ibid.*, p. 5.

Chart 26. Percentage of 1980 high school seniors taking mathematics and science courses



SOURCE: National Center for Education Statistics, U.S. Department of Education

matics for three years, 46 percent for four years, and almost 10 percent for five years (chart 27).[28]

Because the size of the population of high school graduates rose by almost 3 percent since 1972, the 4-point decline in the proportion of high school students in academic programs should not have resulted in a very large drop in the potential pool of new scientists and engineers. In the eighties, however, the decline in this potential pool may become more serious as the number of high school graduates begins to decline.

mathematics and science achievement of precollege students

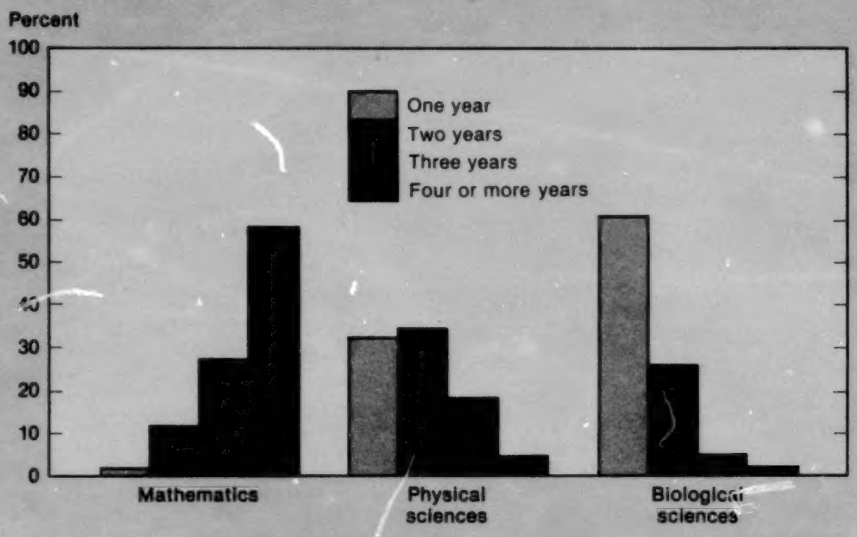
The quality and size of the potential pool of new scientists and engineers are causing concern. Science and engineering may not be attracting as many highly able students as other professions. This is particularly worrisome in light of what appears to be a more general qualitative deterioration as reflected in the performance of all precollege students on various achievement tests.

The National Assessment of Educational Progress (NAEP), funded by the National Institute of Education, is designed to assess the achievements of precollege students in a number of areas, including mathematics and science. (Other areas are art, career and occupational development, citizenship, literature, music, reading, social studies, and writing.)

Two NAEP assessments provide data on changes in mathematics achievement between the early and late seventies.[29] These assessments evaluate performance for four different cognitive process levels—knowledge, skills, understanding, and application. Overall results vary by region, sex, race, parental education, and general measures of socioeconomic status.

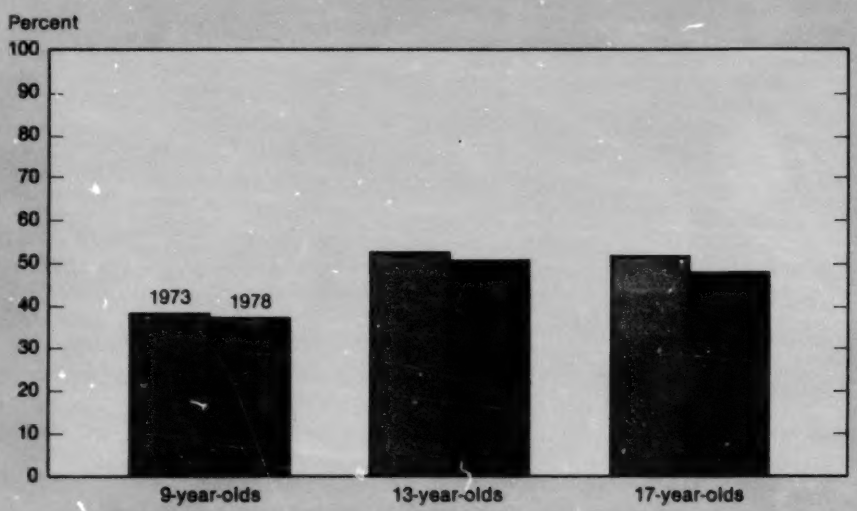
When all items were considered together, the mathematics assessment showed that performance of 9-year-olds declined very slightly between 1973 and 1978 (chart 28). The decline for 13-year-olds was slightly larger, and the decline for 17-year-olds even larger. Average results for knowledge items showed no appreciable change over the 1973-78 period. For skill items, results for 9-year-olds did not change; however, average skill levels of 13- and 17-year-olds declined, with 17-year-olds showing the largest drop. For items testing mathematical understanding, performance of 13- and 17-year-olds declined, although the decline for 13-year-olds may not be statistically significant. All three age groups showed significant average declines on

Chart 27. Percentage of 1981 college-bound seniors taking mathematics and science courses by number of years of study



SOURCE: Admissions Testing Program of the College Board, Educational Testing Service

Chart 28. Average percentages of correct response on mathematics items by age and year



SOURCE: National Assessment of Educational Progress

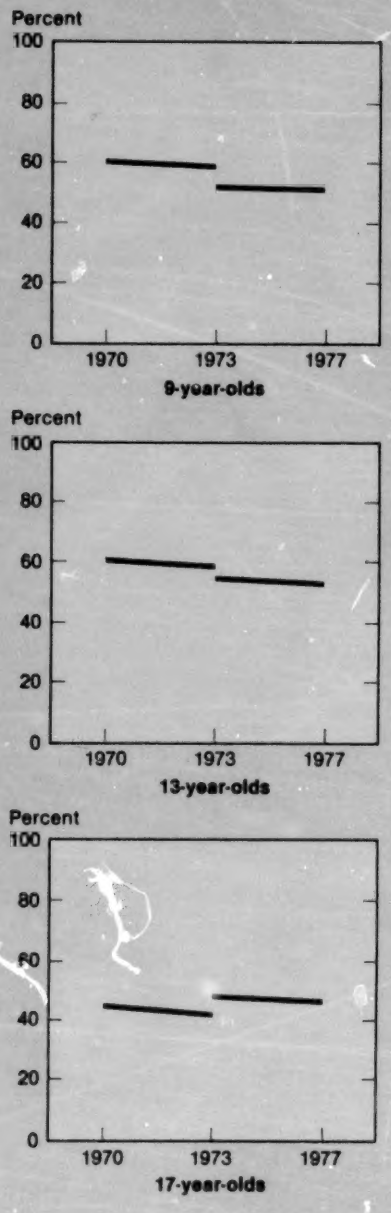
[28] Based on data from Admissions Testing Program of the College Board. *National College Bound Seniors, 1981* (Princeton, N.J.: Educational Testing Service), p. 14.

[29] National Assessment of Educational Progress, *Changes in Mathematical Achievement, 1973-78*, Report No. 09-MA-01 (Denver, Colo. 1979), pp. 18-20.

mathematical applications, which involve the use of mathematical knowledge, skills, and understanding to solve problems.

Science assessments were also conducted by NAEP in 1969, 1973, and 1977 (chart 29). A downward trend in science achievement was observed from the first to the second assessment, but this decline appeared to be diminishing for 9- and 13-year-olds in the third assessment. For these two age groups, it appears that a continued decline in physical science achievement has been accompanied by some stability in biology achievement. The achievement of 17-year-olds declined through the three assessments.[30]

Chart 29. Average correct responses on science items by age and year



NOTE: In order to make the second assessment comparable to the third assessment, certain items were deleted from the second assessment.

SOURCE: National Assessment of Educational Progress

scholastic aptitude test scores of prospective undergraduate s/e students

The SAT is widely used by colleges in admission decisions. The test contains a verbal and a mathematics aptitude test and offers achievement tests in 15 academic subjects. Students who take achievement tests in mathematics and science are generally more academically able than other college-bound seniors, indicating that there is some self-selection occurring in the potential choice of college major. When 1981 college-bound seniors were asked to specify their intended field of study, about 12 percent cited engineering, about 6 percent cited some aspect of computer science, over 7 percent cited social science, and smaller numbers cited majors in other natural or social sciences (chart 30).[31] A relatively low score on the mathematics part of the test could inhibit choice of major or acceptance for study in an S/E field.

Between 1970 and 1981, average verbal SAT scores[32] declined by 36 points (460 to 424), while average mathematical scores declined by 22 points (488 to 466) (chart 31). These declining scores can be attributed to many factors, including greater proportions of average and marginal-achieving students taking the exam. However, an advisory panel of the Educational Testing Service (sponsors of the exam) concluded that only one-fourth of the decline since 1970 could be explained by this factor. Other contributing factors included (a) changes in school curricula, i.e., reduction of required courses, and (b) the impact of television in stressing listening and viewing rather than active participation.[33]

Declining scores may also reflect the nationwide trend toward reduction of high

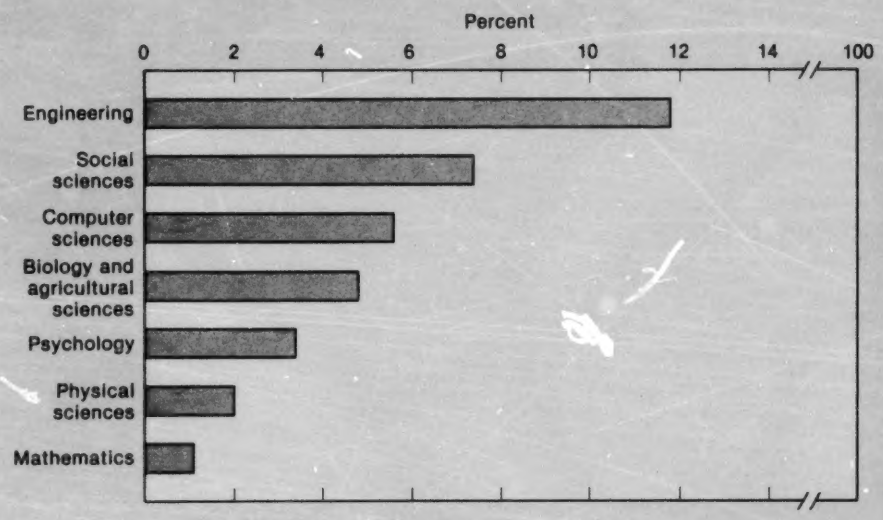
[30] National Assessment of Educational Progress, *Three Assessments of Science, 1969-77: Technical Summary*, Report No. 08-S-21 (Denver, Colo., 1978), pp. 12-15.

[31] Admissions Testing Program of the College Board, *National College-Bound Seniors, 1981, op. cit.*, p. 18.

[32] Score range is between 200 and 800.

[33] College Entrance Examination Board, *On Further Examination: Report on the Advisory Panel on the Scholastic Aptitude Test Score Decline* (New York, N.Y., 1977).

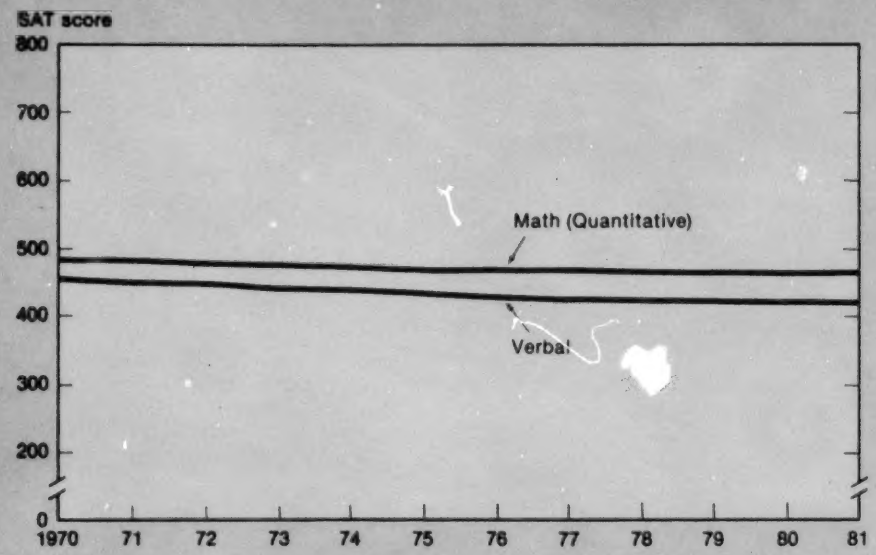
Chart 30. 1981 college-bound seniors by intended undergraduate major[a]



[a] Out of a possible 29 choices.

SOURCE: Admissions Testing Program of the College Board, Educational Testing Service

Chart 31. Scholastic Aptitude Test (SAT) score averages for college-bound seniors: 1970-81



SOURCE: Admissions Testing Program of the College Board, Educational Testing Service

matics scores of 535; for those planning to study the physical sciences, the averages were 495 and 560.

s/e degree production

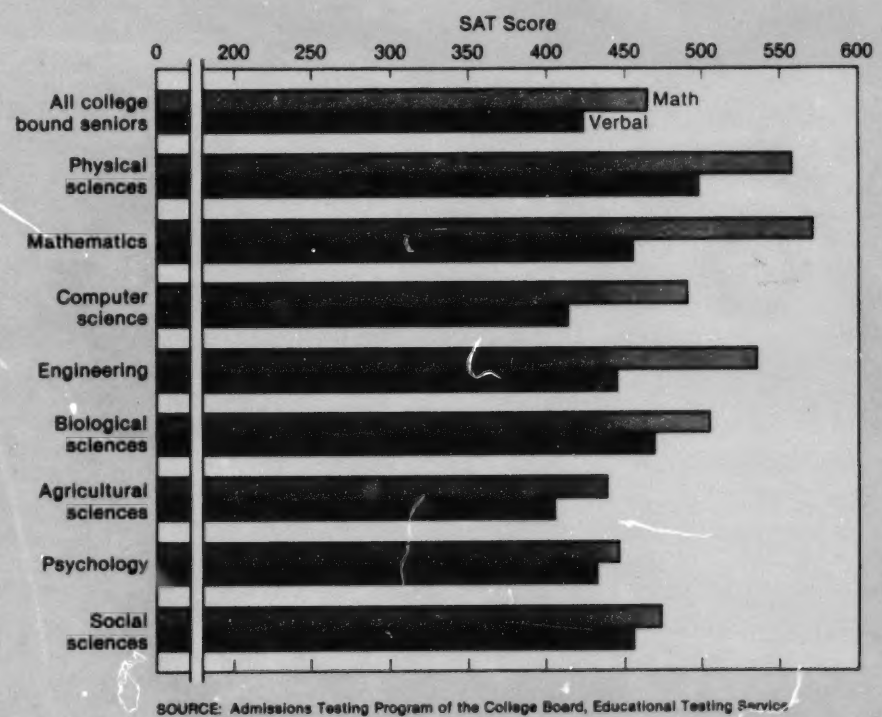
The number of S/E bachelor's degrees awarded annually has exhibited two distinct phases since 1955: (a) a continuous rise from 1955-74 and (b) a decline of about 4 percent between 1974 and 1980 (chart 33).

The first phase reflects a variety of factors that combined to sustain this remarkably long period of growth. "Sputnik," launched in October 1957, influenced the passage of the National Education Defense Act of 1958, which authorized direct, low-interest student loans, graduate fellowships, and several forms of assistance to institutions. Emphasis on the space effort attracted many young people to the physical sciences and engineering. At about the same time, student participation in the

school graduation requirements. Only one-third of the Nation's 17,000 school districts require more than one year of mathematics and science for graduation. Furthermore, universities and colleges have reduced the amount of mathematics and science required for admission.[34]

The steady decline in SAT scores is not reflected in the SAT scores of college-bound seniors intending to major in an S/E field.[35] These students had higher scores than other college-bound seniors (chart 32). Average mathematics scores were higher for those planning to study engineering or the natural sciences than for those planning other areas of study such as business or education. For example, the overall average verbal score of college-bound seniors was 424, and their average mathematics score was 466 (compared to average mathematics scores of 446 for business and 418 for education). Students planning to study engineering had average verbal scores of 444 and average mathe-

Chart 32. 1981 college-bound seniors by intended undergraduate major and Scholastic Aptitude Test (SAT) scores



SOURCE: Admissions Testing Program of the College Board, Educational Testing Service

[34] National Science Foundation, News Release, "Education Commission to Explore Improvement in Science, Math Achievement," NSF PR 82-31 (Washington, D.C.).

[35] Lyle V. Jones, "Achievement Test Scores in Mathematics and Science," *Science*, Vol. 213, July 24, 1981.

biological and social science fields also increased. The Higher Education Act of 1965 initiated major student assistance programs, including work-study and educational opportunity grants and insured loans that became effective in fiscal year 1967. Furthermore, the first wave of the postwar baby-boom generation reached college age in the midsixties.

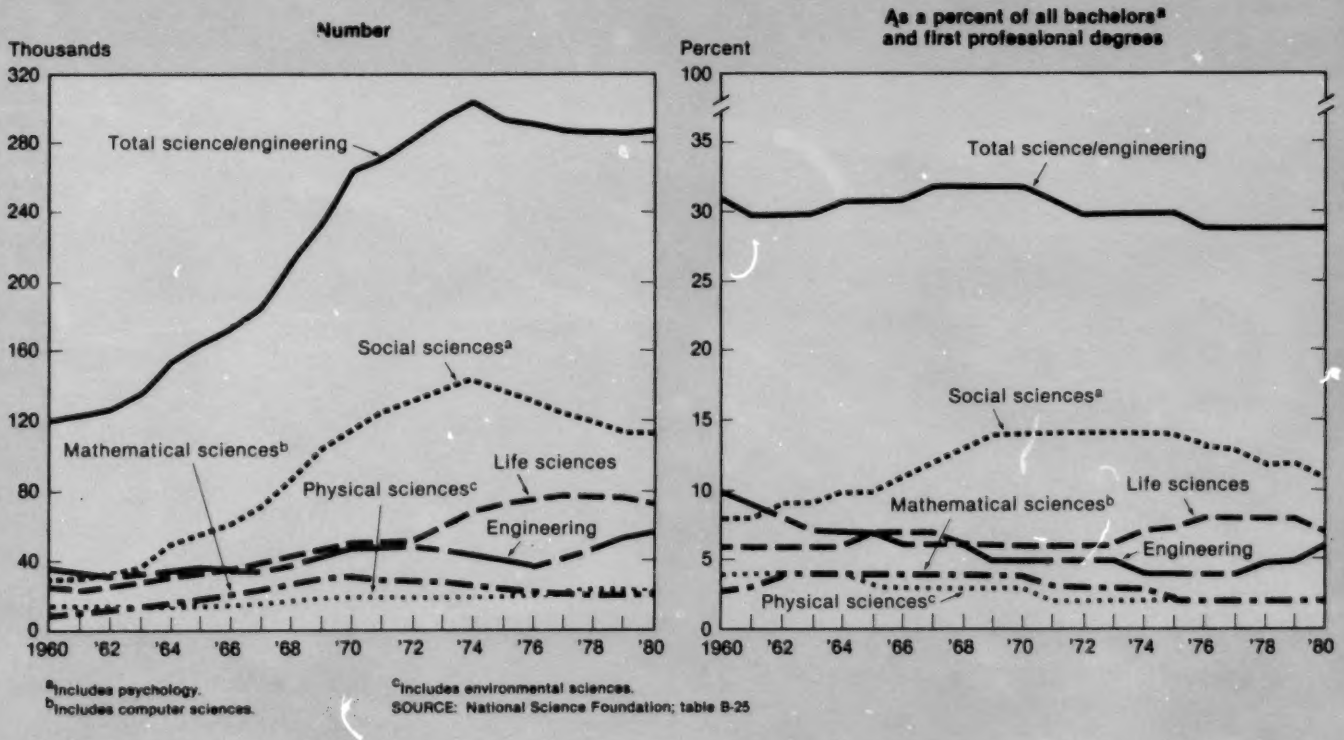
During the second phase, the availability of student aid increased, total enrollments in higher education continued to grow, and demographic declines had not yet reduced the size of the traditional college-age population. On the other hand, the proportion of part-time and unclassified students increased, the S/E share of total bachelor's degrees declined, and the number of S/E bachelor's degrees per thousand 22-year-olds declined.

These trends varied considerably by field (chart 33). The most notable was in engineering, which showed an increase of 51 percent from 1976 to 1980, when it reached a historic high of almost 60,000. The most rapid rates of growth occurred in chemical, mechanical, and "other" engineering fields. The relatively level trend in physical sciences masks a 39-percent decrease in physics from 1969 to 1980 and an increase of more than 300 percent in geological sciences since 1965. Degrees in mathematical sciences have fallen by 22 percent since 1970, but this conceals two divergent trends: Although degrees in mathematics have fallen 58 percent, from over 27,000 in 1970 to 11,500 in 1980, degrees in computer sciences have risen from 1,500 to over 11,000; some of this increase may be due to reclassification of earned degrees. Degrees in social sciences, which increased spectacularly during the Vietnam era, have fallen sharply since 1974: 19 percent in psychology, 47 percent in sociology, 17 percent in political science, and 21 percent in "other" social sciences.

One of the striking developments of the postwar era has been the increasing participation of women in S/E training. The share of S/E bachelor's degrees earned by women increased from 12 percent in 1950 to 36 percent in 1980. Women received only 175 engineering degrees in 1950, but the number rose to 6,100 in 1980. Similar trends are apparent for master's degrees and doctorates in S/E fields. Clearly, the representation of women in the S/E work force will continue to increase in the future.

Although the size of the traditional college-age population is considered to be one of the basic factors in determining degree production potential, only about

Chart 33. Science/engineering bachelor's and first-professional degrees awarded by field: 1960-80



[a]Includes psychology.
[b]Includes computer sciences.
[c]Includes environmental sciences.
SOURCE: National Science Foundation; table B-25

40 percent of the 1955-80 increase may be attributable to demographic changes. In 1955, the lowest year in the production of S/E bachelor's and first-professional degrees since World War II, there were about 2,000,000 persons 22 years of age, which is the normal age for baccalaureate recipients; 39 S/E degrees were awarded per thousand 22-year-olds. If this 1955 rate of degree production had remained constant, the number of degrees produced in 1980 would have increased only about 82,000 over the 1955 level; however, the actual increase was 211,000.

The remainder of the 1955-80 increase, about 60 percent, may be accounted for by changes in other factors that include, in addition to interest in S/E careers, changes in the value of education as perceived by young people, their parents, and employers; the availability of desired educational opportunities; and economic capability of would-be students, including the availability of various types of student aid.

Population projections do not indicate any major changes in the number of 22-year-olds by the year 1984. Therefore, demographic factors should have little influence on the number of bachelor's degrees in the near future, and changes over the next few years will be primarily the result of changes in nondemographic factors. However, from 1984 through 1990, the population of 22-year-olds is projected to decrease to a level about 17 percent less than the estimated 1980 population, suggesting that degree production could decline if demographic factors predominate.

In 1980, about 292,000 bachelor's degrees were granted in science and engineering. In addition, about 54,000 master's degrees and 17,000 doctorates were granted in S/E fields (charts 33, 34, and 35). The number of master's degrees in science and engineering increased steadily through the midseventies, peaking at 56,700 in 1977 and declining to 54,400 by 1980. The pattern in S/E doctorates was similar to that of S/E bachelor's degrees: after climbing steadily, but at a decreasing rate, the number peaked in 1973 and began to decline. By 1980, the number of granted S/E doctorates was about 9 percent below 1972.

As discussed earlier, the number of 22-year-olds affects the number of bachelor's degrees produced. Analogously, the number of bachelor's-degree recipients defines the pool from which recipients of graduate degrees are drawn when the appropriate number of years are added.[36] Although the period of time required to complete a degree is not the same for all advanced-degree recipients, on the average S/E master's degrees may be appropriately related to bachelor's degrees received two years earlier and doctorate degrees may be related to bachelor's degrees received seven years earlier.[37] S/E master's degrees as a percentage of bachelor's degrees received two years earlier increased from almost 19 percent in 1957 to 26 percent in 1968 and then declined to 19 percent in 1974 and remained near that level through 1980.[38] If the 26-percent rate of the late sixties had been achieved in 1980, the number of S/E master's degrees would have increased by 30,000, from 45,000 in 1968 to 75,000 in 1980. The actual increase was only 9,000.

The same general pattern occurred at the doctorate level. The highest continuation rate, 13 percent, was not reached until 1970, and the subsequent decline to below 6 percent in 1980 was relatively more severe than the decline in the rate for master's degrees. If the rate had remained at the high of 13 percent, production of S/E doctor's degrees would have increased by over 20,000, from 17,600 in 1970 to 38,400 in 1980; however, actual degree production fell slightly. The trends in doctorate continuation rates were similar for both men and women, but the gap between men and women has been narrowing.

The conclusion to be drawn regarding graduate degree production parallels that for S/E bachelor's degrees. Nondemographic factors—such as the perceived value and availability of S/E graduate training and the ability of would-be graduate students to finance this training (including all types of student aid)—have played and will continue to play an important role in advanced S/E degree production.

The number of S/E degrees is also sensitive to the state of the labor market.[39] There is a positive relationship between the number of students pursuing and earning degrees in a specific field and salaries and other indicators of relative economic opportunities in the field. For example, a 5-percent increase in the starting salaries of engineers can be associated with an increase of 10 to 20 percent in the production of engineering baccalaureates.[40] Thus, when demand in a field exceeds supply, as evidenced by relatively high starting salaries or intensified recruitment activity, more students are likely to select that field of study.

Frequently, however, there is an overresponse to this excess demand because of the long lead time that occurs before supply change affects the labor market. Engineering fields provide a clear example of such repeated oscillations between "shortages" and "surpluses," and research suggests that there are similiar patterns in the fields of physics, mathematics, and chemistry.[41] According to recent labor market indicators (chapter 1), job and salary opportunities remain relatively strong for engineers and computer specialists; this is confirmed by employment and salary statistics for recent S/E graduates. Thus, the strong upward trends in degree production for these fields are expected to continue in the immediate future.

These trends also have implications for the S/E share of total degree fields. At the bachelor's level, this share was relatively stable at slightly above 30 percent until 1970, when it began to decline gradually (chart 33); by 1980, it represented about 29 percent of the total. For master's degrees, the share declined steadily from 30 percent in 1965 to 17 percent in 1976 (chart 34). This trend was primarily the result of the

[36] This pool is limited to S/E degrees although it is recognized that some S/E baccalaureates receive advanced degrees in nonscience fields and vice versa.

[37] For a discussion of the baccalaureate-to-doctorate time lapse, see National Academy of Science, *A Century of Doctorates* (Washington, D.C., 1978).

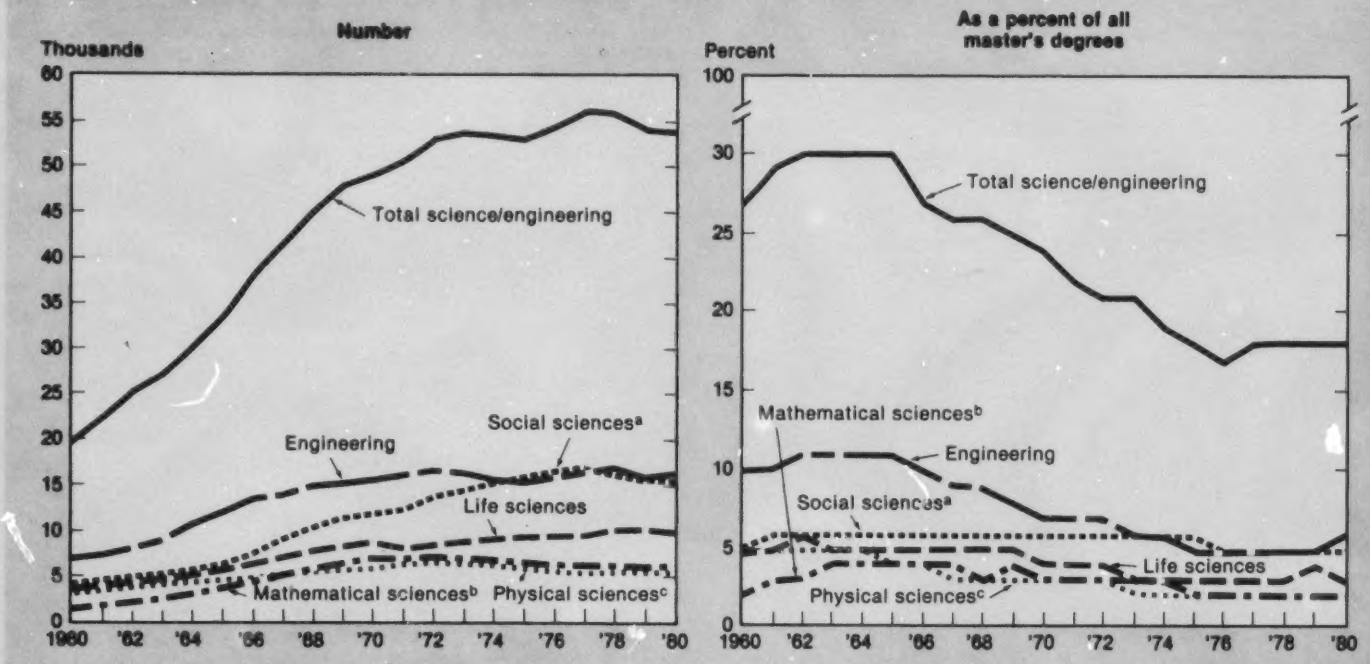
[38] Bachelor's degrees in 1955 are used as the starting point to avoid the years with large numbers of World War II veterans.

[39] For more detailed discussions of this subject, see Richard B. Freeman, *The Market for College Manpower* (Cambridge, Mass.: Harvard University Press, 1971); "Supply and Salary Adjustments to the Changing Scientific Manpower Market, Physics 1948-75," *American Economic Review*, March 1975; and "A Cobweb Model of Supply and Starting Salary of New Engineers," *Industrial and Labor Relations Review*, January 1976.

[40] Richard B. Freeman, "A Cobweb Model of Supply and Starting Salary of New Engineers," *op. cit.*

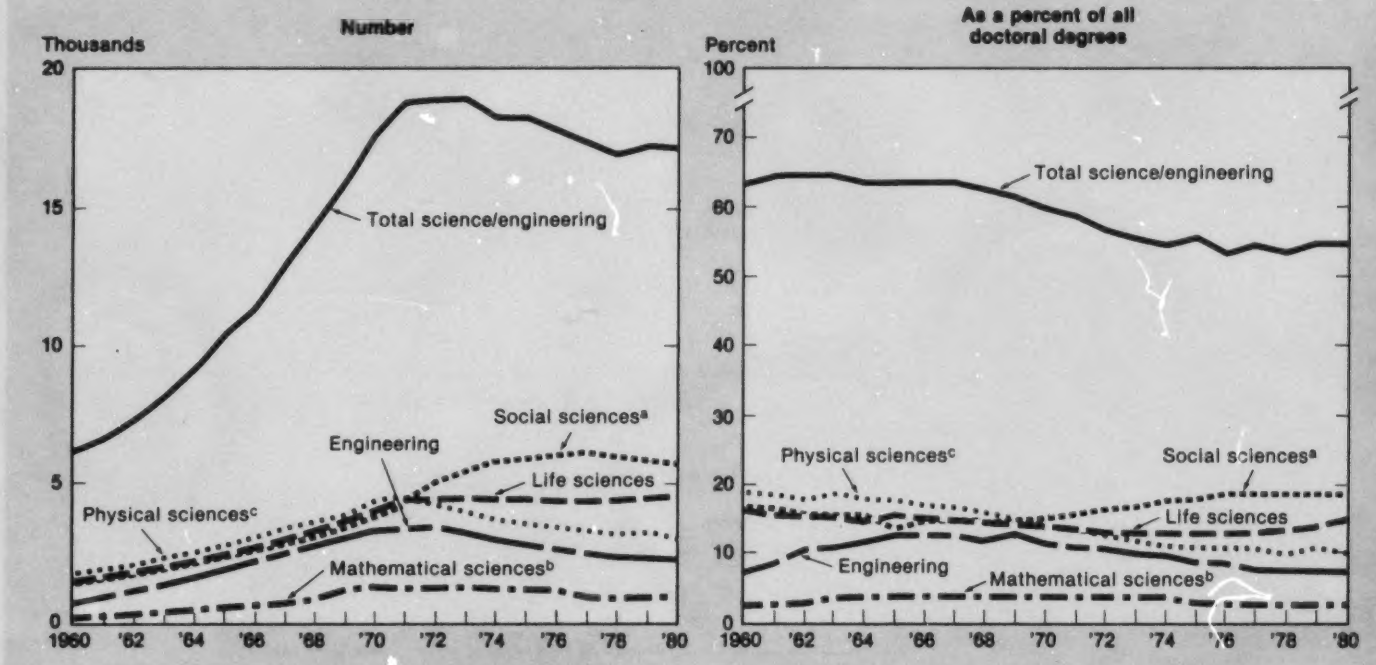
[41] See Richard B. Freeman and Jonathan Leonard, "Autoregressive Degree Patterns: Evidence of Endogenous Cycles in the Market," *Industrial Research Association, Proceedings of the Thirteenth Annual Winter Meeting*, December 29-30, 1977, pp. 13-14.

Chart 34. Science/engineering master's degrees by field: 1960-80



[a]Includes psychology.
[b]Includes computer sciences.
[c]Includes environmental sciences.
SOURCE: National Science Foundation; table B-26

Chart 35. Science/engineering doctorates awarded by field: 1960-80



[a]Includes psychology.
[b]Includes computer sciences.
[c]Includes environmental sciences.
SOURCE: National Science Foundation; table B-27

dramatic decline in the share of engineering degrees, which dropped by more than 50 percent. The decline slowed to less than 1 percent between 1976 and 1980, but it is too soon to conclude that the trend has reversed itself; such a judgment must wait until several more years of data are available for analysis.

For S/E doctorates, the trend in shares roughly paralleled the trend for master's degrees; the S/E share declined from 64 percent in 1975 to 54 percent in 1976 and increased slightly in 1979 and 1980 (chart 35).

new entrants

Persons receiving S/E degrees are the major source of supply to S/E labor markets, but the number earning S/E degrees, especially at the undergraduate level, is not identical to the supply of new S/E workers. For various reasons, some who receive S/E baccalaureate degrees do not enter the S/E labor force. For example, graduate education is usually a prerequisite for employment in some fields. Likewise, some S/E baccalaureates seek to enter professional schools in other fields, such as medicine, law, or business. Almost all those taking the medical school admission test in 1977-78 (92 percent)[42] held undergraduate S/E degrees, as did 34 percent of those taking the graduate business school admission tests that same year.[43]

In analyzing the flow of new graduates to the S/E labor market two key variables are the number of S/E degrees granted and the proportion of those earning S/E degrees who enter the S/E labor force. In turn, the number earning S/E degrees at various levels depends on several variables, including demographic factors, relative economic opportunities, and precollege mathematical and science training and aptitudes.

transition from school to work

The transition of recent S/E graduates from school to work is shown in table 4. Only a fraction of these S/E degree recipients were employed in S/E occupations within two years after graduation. This can be attributed to several factors. First, a substantial number of graduates, especially at the baccalaureate level, postponed entry into the labor force by pursuing full-time graduate degrees. Second, a small fraction of the individuals were not employed, either because they chose to remain outside the labor force or because they were unable to find employment. Finally, not all individuals who gained employment, especially those at the bachelor's level, were employed in S/E occupations.

S/E Utilization Rates. The ability of young S/E graduates to find S/E jobs is significantly influenced by degree level as well as field. About one-half of the 1978 bachelor's-degree recipients, compared to four-fifths of the 1978 master's-degree recipients, found S/E employment in 1980; 90 percent of the 1977 Ph.D. recipients found employment in 1979 (chart 36).

These S/E utilization rates varied widely by field, however. For example, at the bachelor's level, degree recipients in computer sciences and engineering were almost twice as likely to find S/E jobs as life science graduates and about four times more likely than social science graduates. This effect diminishes greatly at the advanced degree levels, where utilization rates are consistently high across most S/E fields. Since the S/E utilization rate is an indication of the relative demand for new graduates in the S/E labor market, the data reflect the recent strong demand for computer specialists and engineers, a somewhat lower demand for physical science and mathematics degree holders, and a much lower demand for social science degree recipients. An advanced degree is generally considered necessary for professional standing in these latter fields, and it has a marked effect on S/E employment opportunities.

An analysis of S/E utilization rates shows an increase in the overall rate—from a 41-percent utilization rate of 1974 bachelor's-degree recipients in 1976 to a 50-percent utilization rate of 1978 recipients in 1980. Data regarding master's recipients over the same period reveal a similar pattern, although somewhat reduced in magnitude. These increases in the ability to find S/E employment, which took place among degree holders in the natural sciences and engineering but not among those in the social sciences, accompanied recovery from the general economic downturn of the mid-seventies. The increase in the S/E utilization rate of mathematical science degree recipients again reflects the increasing demand for computer specialists, since many of those with degrees in mathematics have found employment in computer specialties.

Sector of Employment. The sectoral shifts in the employment of new S/E graduates since 1976 can be attributed to several factors, including (a) the economic recovery of the midseventies that contributed to the sharp increase in industrial employment, (b) a decline in academic employment opportunities driven in part by financial uncertainties resulting from actual or expected declines in academic enrollments, and (c) a greater emphasis on S/E skills by the Federal Government in addressing technological issues.

Table 4. Transition of recent science/engineering (S/E) degree recipients from school to work

[In thousands]

Degree recipient	Population[1]	Labor force	Total employed	In S/E	Outside S/E	Unemployed	Outside labor force	Full-time graduate students
Bachelor's[2] ..	230	223	216	112	104	7	7	69
Master's[2]	45	44	43	36	8	1	1	11
Doctorates[3] ..	17	16	16	15	1	1	1	——

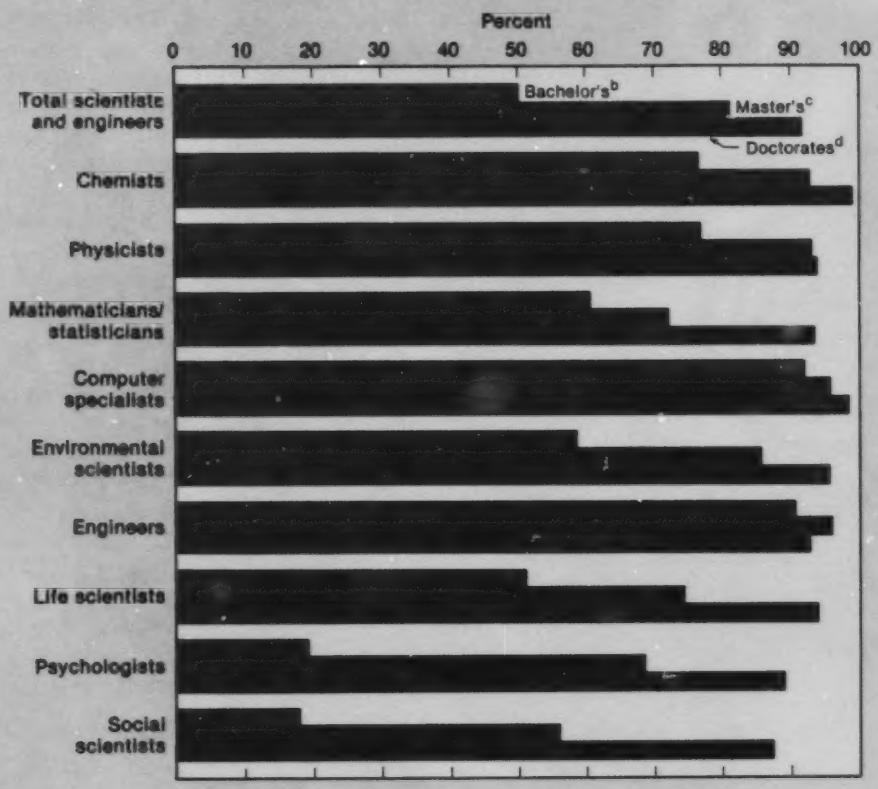
[1] Excludes Full-time graduate students.
[2] 1978 graduates in 1980.
[3] 1977 graduates in 1979.

SOURCE: National Science Foundation

[42] American Association of Medical Colleges, *Medical School Admission Requirements, U.S.A. and Canada, 1979* (Washington, D.C.), pp. 5-6 and 9.

[43] Educational Testing Service, unpublished data (Princeton, N.J.). Between 1973-74 and 1977-78, the proportion of S/E bachelor's-degree recipients taking the graduate business school admission test rose from 19 percent to 34 percent.

Chart 36. Science/engineering (S/E) utilization rates[a] of recent degree recipients[b] by field and level of degree



[a]The science/engineering utilization rate is defined as the number employed in science and engineering as a percent of the labor force.
[b]Excludes full-time graduate students and those holding postdoctoral appointments.
[c]1978 graduates in 1980.
[d]1977 graduates in 1979.
SOURCE: National Science Foundation, unpublished data

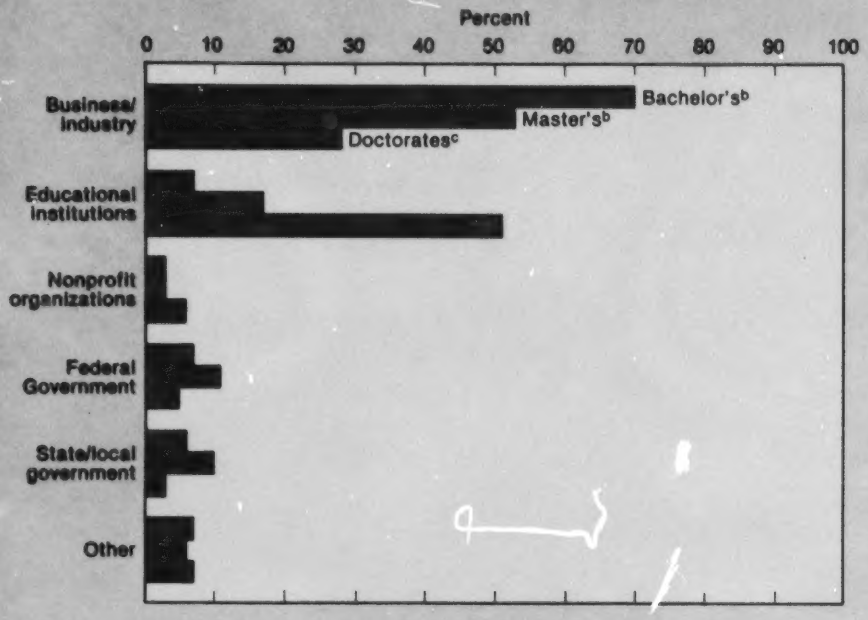
Examination of the employment affiliation of recent S/E graduates shows significant variation by degree level. Data showing employment of 1978 S/E bachelor's and master's recipients in 1980 and 1977 doctorate recipients in 1979 indicate a shift from industrial to academic employment with the attainment of an advanced degree (chart 37). Only 28 percent of recent doctorates, but about 70 percent of recent baccalaureate recipients, employed in S/E jobs were working in industry. Conversely, only 7 percent of the bachelor's recipients were academically employed, in contrast to about 50 percent of the doctorate holders. The sectoral distribution of master's recipients fell between those of baccalaureates and doctorates, although more than one-half were industrially employed.

The private sector accounted for the major increase of recent baccalaureate graduates in S/E employment between 1976 (1974 graduates) and 1980 (1978 graduates). The increase was 13 percent for all sectors; however, the industrial sector showed a 36-percent increase, and the nonprofit sector showed a 25-percent increase. Relatively small gains were registered by educational institutions (9 percent) and the Federal Government (6 percent). This increase in industrial employment among baccalaureate holders is closely tied to computer occupations, which comprised about one-half of the S/E employed graduates from 1976 (1974 graduates) but accounted for more than 90 percent of the increase in industrial employment observed by 1980 (1978 graduates). The gains were offset by a sharp absolute decline in the number hired for S/E jobs within other sectors of the economy.

A comparison of S/E master's-degree recipients reveals a similar pattern. The number employed in S/E jobs in 1980 was 11 percent greater than in 1976. Again, industrial hiring accounted for much of this growth (a 43-percent gain), while the Federal Government accounted for the balance. All other sectors of the economy showed a decline during this 4-year period.

Primary Work Activity. Research and development remains the dominant work activity of new graduates entering S/E occupations, although their involvement in research and development is clearly related to degree level. Among baccalaureate recipients, about 36 percent reported

Chart 37. Distribution of recent science/engineering graduates[a] by sector of employment and level of degree



[a]Excludes full-time graduate students and those holding postdoctoral appointments.
[b]1978 graduates in 1980.
[c]1977 graduates in 1979.
SOURCE: National Science Foundation, unpublished data

research and development as their primary work activity, compared with about one-half (49 percent) of the doctorates. About two-fifths of the job holders with master's degrees reported participation in R&D activities (chart 38). Other work activities that display significant degree effects include teaching, sales and professional services (which increase for more advanced degree levels), production and inspection, and reporting, statistical, and computing activities (which decrease for advanced degree levels).

The degree effect may also be due to differences in field distribution among employment sectors. The large number of engineering and computer science occupations at the baccalaureate level, for example, are mainly oriented to production-related and reporting, statistical, and computing activities. Moreover, these occupations are concentrated in industrial settings, where the focus on research is less than in academia. Given the relative complexity of research, the academic sector would be much more inclined to hire graduates with advanced degrees.

occupational mobility

Occupational changes are one mechanism for alleviating market imbalances, especially in the short run. Throughout the seventies, NSF has been following a longitudinal sample of scientists and engineers who were queried about their labor market experiences.[44] The sample shows that although many (70 percent) changed jobs, few (20 percent) changed their occupations. Of those changing occupations, one-fourth remained within the S/E labor force, one-half moved to management positions, and the remainder went to non-S/E jobs. There were only slight differences between men and women in the degree of occupational mobility.

Chart 39 summarizes the 1972-78 movements from S/E occupations to other S/E jobs, management, and non-S/E occupations. The data show that about 30 percent moved to other S/E occupations, 14 percent changed to management jobs, and 7 percent went to other non-S/E occupations.

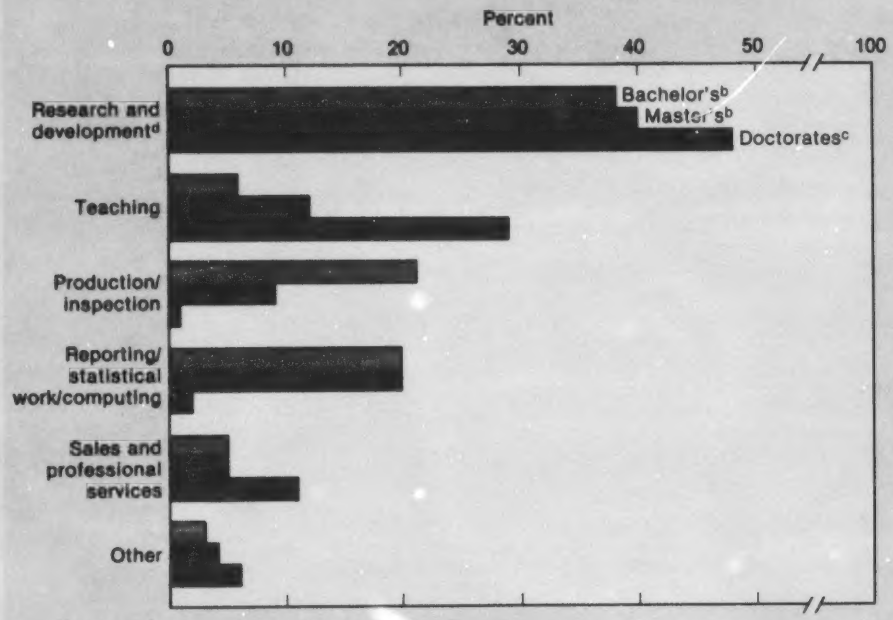
Among scientists, doctorates were less occupationally mobile than nondoctorates, and mathematicians were the most occupationally mobile. There was a strong flow from mathematics, a field with weak demand, to engineering and computer specialties, fields with strong demand. About 8 percent of those employed as mathematicians in 1972 were employed as engineers by 1978 and an additional 7 percent were employed as computer specialists.

There was little movement between engineering and the sciences, and engineers were generally less occupationally mobile than scientists. However, since engineers were aggregated over all specialties, the mobility pattern of engineers does not reflect flows between specialties within engineering. Engineers were more apt than scientists to become managers, and most who changed occupations went into management jobs. This tended to be truer among engineers at the bachelor's-degree level than among others.

The transition from field of degree to field of employment by new S/E graduates also reflects the extent to which market imbalances can be alleviated by mobility. By and large, net transitions have occurred from fields in which employment demand has been weak to fields in which employment demand has been strong. The field distribution of new S/E graduates employed

[44]National Science Foundation, *Occupational Mobility of Scientists and Engineers*, op. cit.

Chart 38. Distribution of recent science/engineering (S/E) degree recipients[a] employed in S/E jobs by primary work activity



[a]Excludes full-time graduate students and those holding postdoctoral appointments.

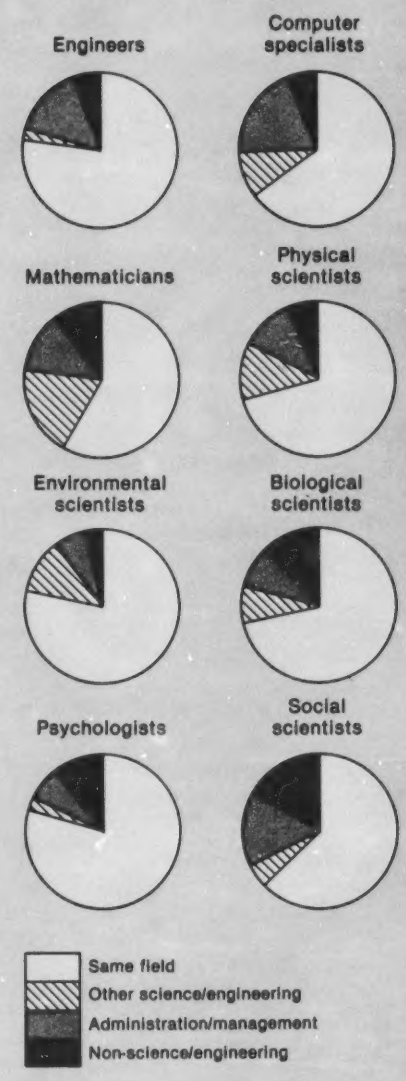
[b]1978 graduates in 1980.

[c]1977 graduates in 1979.

[d]Including management of R&D.

SOURCE: National Science Foundation, unpublished data

Chart 39. Occupational mobility of scientists and engineers: 1972-78



SOURCE: National Science Foundation; table B-33

as computer specialists illustrates these flows. Of the approximately 16,000 S/E baccalaureates employed as computer specialists in 1980, only about 37 percent had earned their bachelor's degrees in computer science; an additional 25 percent had earned mathematics degrees, while the remainder had earned their degrees in the physical, life, and social sciences. At the advanced degree levels, however, the influx of mathematics degree recipients into computer science occupations shows a substantial decline, while the influx of engineering graduates shows an increase (chart 40). A possible explanation is that individuals with graduate engineering degrees may be especially qualified for the work required for design and development of advanced computer systems.

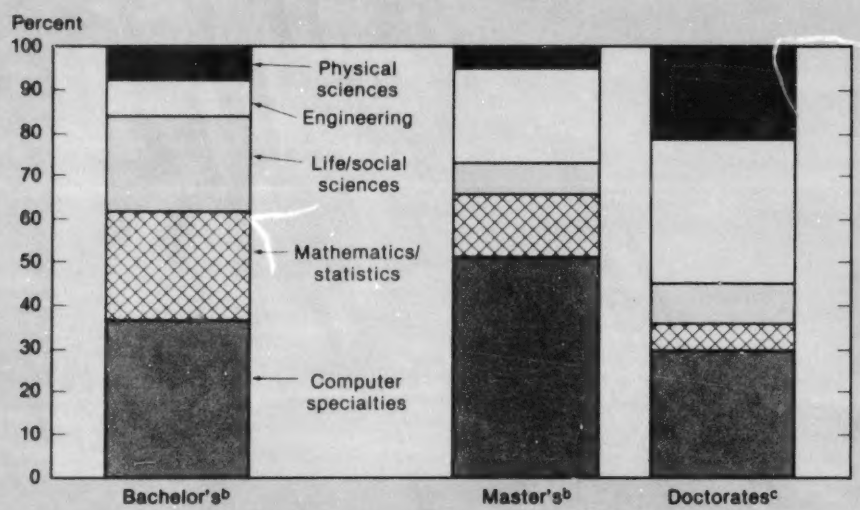
losses to the s/e labor market

Jobs vacated through death and retirement represent one of the chief sources of opportunity for new entrants. In a work force characterized by steady long-term growth and a balanced age distribution, attrition from deaths and retirements would amount to about 2.5 percent annually (based on a 40-year working life). In recent S/E labor markets, however, there have been proportionately fewer older workers because of the rapid expansion of jobs in the fifties and sixties. Calculations based on unpublished data from the Bureau of Labor Statistics suggest that annual attrition in the late seventies probably amounted to approximately 1.5 percent of the S/E labor force.[45] Thus, with a current force of approximately 2.9 million, about 45,000 should be leaving each year because of death and retirement. Estimated attrition rates vary for specific occupations, ranging from less than 1 percent for computer specialists to 2.5 percent for mining engineers—a slowly growing occupation in the sixties and early seventies.

Attrition rates depend on three factors—age distribution, life expectancy, and length of time people choose to work. With regard to age, a sharp rise in S/E attrition rates may result around 1990, when many of those scientists and engineers who started work during the fifties reach retirement age. Life expectancy, probably the least important factor, may lower attrition slightly because of the slight decrease in age-specific probabilities of death. Potentially more immediate and significant effects on attrition could come from changes in the length of time that scientists and engineers choose to remain in the labor force.

Statistics show a trend toward lower retirement ages. According to unpublished data from the Bureau of Labor Statistics, the continuation of this trend could, by itself, add one-half a percentage point to the annual 1.5-percent attrition rate of the S/E work force by 1985. The trend may be counteracted, however, by Federal legislation and the state of the economy. In 1978, Congress passed the Age Discrimination in Employment Act Amendments, which prohibit compulsory retirement before age 70. Since the amendments will enable some older scientists and engineers to remain in the work force longer, a decrease in attrition could result. Moreover, price instabilities coupled with high annual inflation rates make potential retirees uncertain of the future purchasing power of their pensions. Hence, these people may be reluctant to choose early retirement. It is difficult to assess the net effect of these factors on future S/E labor force attrition rates.

Chart 40. Distribution of recent science/engineering degree recipients[a] employed as computer specialists by field and level of degree



[a]Excludes full-time graduate students and those holding postdoctoral appointments.
[b]1978 graduates in 1980.
[c]1977 graduates in 1979.
SOURCE: National Science Foundation; table B-30 and unpublished data

[45] The Bureau of Labor Statistics information applied separation rates by age for all men and women in the labor force to the age distribution by sex of each occupation. Therefore, the BLS rates do not reflect any possible differences between separation patterns by age for scientists and engineers as compared to all workers. See, for example, Howard N. Fullerton, Jr., "A New Type of Working Life Table for Men," *Monthly Labor Review*, July 1972.

appendixes

a. technical notes
b. statistical tables

appendix a

technical notes

The National Science Foundation (NSF) publishes estimates of the number, type of employer, work activity, and other economic and demographic characteristics of persons who meet its particular definition of a scientist or engineer. Broadly speaking, a person is considered a scientist or engineer if at least two of the following criteria are met:

- Highest degree held in a science (including social sciences) or engineering (S/E) field
- Employed in an S/E occupation
- Professional identification as a scientist or engineer based on total education and work experience

concepts and definitions

Overall estimates of the characteristics of scientists and engineers have been derived biennially since 1974 by integrating information produced by sample surveys from the Scientific and Technical Personnel Data System (STPDS). The mathematical model used to generate these estimates was recently changed. Therefore, some data presented in this publication for 1976 and 1978 will differ slightly from those appearing in earlier publications. For a detailed description of these changes and their consequences in producing 1980 national estimates, see *U.S. Scientists and Engineers, 1980* (Detailed Statistical Tables) (NSF 82-314). The STPDS includes three samples:

- *National Sample of Experienced Scientists and Engineers*—Those scientists and engineers in the labor force at the time of the 1970 Census of the Population. Because of the 1980 Census, the Bureau of the Census was not able to undertake the 1980 Experienced Sample. Estimates were derived by updating the 1978 survey results and are therefore not as reliable as earlier estimates. Experienced scientists and engineers constitute about one-half of the 1980 national estimates.
- *Survey of Recent Science and Engineering Graduates*—Those receiving, after 1970, a master's degree in mathematics, biological science, psychology, economics, sociology, or other social science field; those holding a bachelor's degree in any of these fields and employed in science and engineering; and those holding a baccalaureate in any other S/E field.
- *Survey of Doctorate Recipients*—Those receiving a doctorate in an S/E field, or receiving a doctorate in a non-S/E field and working in science and engineering.

occupation/field of science or engineering

Data on field of science or engineering are derived from responses to questions on the various surveys. Fields are classified as follows:

- *Physical sciences*—Chemistry, physics, astronomy, and other physical sciences, including metallurgy
- *Environmental sciences*—Earth, atmospheric, and oceanographic sciences, including geophysics, geology, seismology, and meteorology
- *Life sciences*—Agricultural, biological, and medical sciences (excluding those primarily engaged in patient care)

- *Mathematical sciences*—Mathematics and statistics
- *Social sciences*—Economics, including agricultural economics, sociology, anthropology, and all other social sciences
- *Psychology*
- *Computer specialties*
- *Engineering*

Data on field of employment are derived from responses to questions that request—based on employment specialties lists included with the questionnaire—the name of the specialty most closely related to the respondent's principal employment. Those who selected an employment specialty not in science or engineering are assigned to a field of science or engineering based on field of their degree, and for those with less than a doctorate, their professional self-identification.

primary work activity

Data presented on the work activities of scientists and engineers represent their *primary* work activities. The data are derived from responses to a series of questions on the survey instruments that ask individuals (a) to specify their primary work activity and (b) to provide a percentage of distribution of their work time among 10 to 15 listed activities.

other variables

Information on other economic and demographic variables, such as type of employer, race, and sex, are based on individual responses to survey questions. The various survey instruments used by the Division of Science Resources Studies are shown in *A Guide to NSF Science Resources Data.* (See "Data Source Publications" on p. 38.)

reliability of scientists and engineers estimates

Since the data on scientists and engineers are derived from sample surveys, the estimates are subject to both sampling and nonsampling errors.

The sample used for a survey is only one a large number of possible samples of the same size that could have been selected using the same sample design. Even if the same questionnaire and instructions were used, the estimates from each of the samples would differ from each other. The deviation of a sample estimate from the average of all possible samples is defined as sampling error. The standard error of a survey estimate attempts to provide a measure of this variation and thus is a measure of the precision with which an estimate from the sample approximates the average results of all possible samples. Information on standard errors for the major S/E data series used in this report can be found in the appropriate publications listed below.

Nonsampling errors can be attributed to many sources: inability to obtain information about all cases; definitional difficulties; differences in the interpretation of questions; inability or unwillingness to provide correct information on the part of the respondents; mistakes in recording or coding the information; and other errors of collection, response, processing, coverage, and imputation. Nonsampling errors are not unique to sample surveys since they can, and do, occur in complete canvasses as well. No systematic attempt has been made to identify or approximate the magnitude of the nonsampling errors associated with the estimates of scientists and engineers presented in this report.

statistical measures

labor force participation rates

The labor force is defined as those employed and those seeking employment. The labor force participation rate (LFPR) is the ratio of those employed (E) and those unemployed but seeking employment (U) to the population (P):

$$LFPR = \frac{E + U}{P}$$

s/e utilization rates

The S/E utilization rate (ES/E) measures the ratio of those holding jobs in science or engineering (S/E) to the total S/E labor force (LF), which includes those scientists and engineers employed in any job and those seeking employment:

$$ES/E = \frac{S/E}{LF}$$

s/e employment rates

The S/E employment rate (es/e) measures the ratio of those holding jobs in science or engineering (S/E) to the total employment (E) of scientists and engineers, which includes those holding non-S/E jobs:

$$es/e = \frac{S/E}{E}$$

unemployment rates

The unemployment rate (UER) shows the ratio of those who are unemployed and seeking employment to the total labor force (LF = E + U):

$$UER = \frac{U}{E + U}$$

data source publications

Details on survey methods, coverage, concepts, definitions, and reliability of the data used in this report are contained in the following publications of the National Science Foundation:

U.S. Scientists and Engineers: 1980 (Detailed Statistical Tables) (NSF 82-314).

Characteristics of Doctoral Scientists and Engineers in the United States: 1979 (Detailed Statistical Tables) (NSF 80-323).

Characteristics of Experienced Scientists and Engineers: 1978 (Detailed Statistical Tables) (NSF 79-322).

Characteristics of Recent Science and Engineering Graduates: 1980 (Detailed Statistical Tables) (NSF 82-313).

For a brief description of each survey and copies of the survey instruments see *A Guide to NSF Science Resources Data,* available from the Editorial and Inquiries Unit, Division of Science Resources Studies (L-611), National Science Foundation, Washington, DC 20550.

appendix b

statistical tables

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Table B-1. Scientists and engineers by field, sex, and labor force status: 1976, 1978, and 1980

Field and sex	Total			Labor force			Outside labor force		
	1976	1978	1980	1976	1978	1980	1976	1978	1980
All fields	2,523,600	2,873,500	3,110,700	2,369,000	2,671,000	2,906,000	154,600	202,600	204,800
Men	2,270,600	2,556,400	2,702,600	2,148,500	2,391,600	2,537,800	122,100	164,800	164,700
Women	253,000	317,100	408,100	220,500	279,300	368,100	32,500	37,800	40,000
Physical scientists	223,600	255,100	266,900	200,700	221,400	224,400	22,900	33,700	37,500
Men	193,600	223,100	226,000	178,500	196,600	196,700	17,800	26,500	29,200
Women	27,300	32,000	35,900	22,200	24,800	27,600	5,100	7,200	8,300
Mathematical scientists	96,000	106,000	127,000	90,200	99,300	119,800	5,800	6,800	7,200
Men	79,700	87,800	101,300	76,200	83,000	96,400	3,500	4,700	4,900
Women	16,300	18,300	25,800	14,000	16,200	23,400	2,300	2,000	2,300
Computer specialists	209,500	306,800	354,900	204,100	299,600	347,500	5,400	7,100	7,400
Men	171,900	239,400	260,100	169,900	236,700	257,400	2,100	2,700	2,700
Women	37,600	67,400	94,800	34,200	62,900	90,100	3,400	4,500	4,700
Environmental scientists	70,800	89,700	102,600	66,300	82,900	94,400	4,600	6,700	8,200
Men	65,600	81,000	90,200	61,900	75,200	83,400	3,700	5,700	6,800
Women	5,300	8,700	12,500	4,300	7,700	11,000	900	1,000	1,400
Engineers	1,266,700	1,415,500	1,497,100	1,191,300	1,314,900	1,400,500	75,400	100,600	96,600
Men	1,253,800	1,394,700	1,462,300	1,179,700	1,295,000	1,367,300	74,100	99,600	95,000
Women	12,900	20,800	34,800	11,600	19,900	33,200	1,300	1,000	1,500
Life scientists	298,300	349,400	404,700	282,900	326,900	381,300	15,400	22,500	23,400
Men	242,700	280,700	314,300	234,600	268,600	301,300	8,100	12,100	13,000
Women	55,600	68,700	90,400	48,300	58,400	80,000	7,300	10,300	10,400
Psychologists	118,200	127,400	132,600	112,300	119,600	124,700	5,900	7,800	7,900
Men	77,900	81,300	79,900	75,800	78,600	76,900	2,100	2,700	3,100
Women	40,300	46,100	52,700	36,600	41,000	47,900	3,800	5,000	4,900
Social scientists	240,500	223,700	229,700	221,300	206,300	213,200	19,100	17,400	16,500
Men	182,600	168,600	168,400	172,000	157,900	158,400	10,700	10,700	10,000
Women	57,800	55,100	61,400	49,400	48,400	54,900	8,500	6,700	6,500

NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-2. Engineers by specialty, sex, and labor force status: 1976, 1978, and 1980

Field and sex	Total			Labor force			Outside labor force		
	1976	1978	1980	1976	1978	1980	1976	1978	1980
Engineers	1,266,700	1,415,500	1,497,100	1,191,300	1,314,900	1,400,500	75,400	100,600	96,600
Men	1,253,800	1,394,700	1,462,300	1,179,700	1,295,000	1,367,300	74,100	99,600	95,000
Women	12,900	20,800	34,800	11,600	19,900	33,200	1,300	1,000	1,500
Aeronautical/astronautical	41,100	44,900	49,200	39,700	42,700	47,100	1,400	2,300	2,200
Men	40,200	43,900	47,500	39,100	41,900	45,600	1,100	2,000	1,900
Women	900	1,000	1,700	600	800	1,500	300	200	200
Chemical	63,500	69,900	76,900	60,700	66,400	73,200	2,800	3,400	3,700
Men	61,800	67,500	73,100	59,100	64,100	69,500	2,700	3,400	3,600
Women	1,700	2,400	3,800	1,600	2,300	3,700	100	100	100
Civil	160,600	187,400	200,400	154,100	176,100	189,500	6,500	11,300	10,900
Men	158,700	184,800	196,300	152,200	173,600	185,600	6,500	11,200	10,700
Women	1,900	2,600	4,100	1,900	2,500	3,900	(*)	100	200
Electrical/electronic	201,700	245,500	269,000	196,900	234,400	257,800	4,900	11,200	11,200
Men	200,500	243,500	264,900	196,100	232,500	253,900	4,400	11,100	11,000
Women	1,200	2,000	4,100	800	1,900	3,900	400	100	200
Mechanical	211,600	230,500	244,100	207,400	221,500	234,800	4,100	9,000	9,300
Men	210,300	228,100	240,100	206,200	219,100	231,000	4,100	9,000	9,200
Women	1,300	2,400	3,900	1,200	2,400	3,800	(*)	(*)	100
Other	588,200	637,300	657,500	532,500	573,900	598,100	55,700	63,400	59,300
Men	582,300	626,800	640,300	527,000	563,800	581,800	55,300	63,000	58,600
Women	5,900	10,500	17,100	5,500	10,100	16,400	400	400	700

*Too few cases to estimate.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-3. Scientists and engineers by field, sex, and employment status: 1976, 1978, and 1980

Field and sex	Total employed									Unemployed, seeking		
	Total			In science/engineering			Outside science/engineering					
	1976	1978	1980	1976	1978	1980	1976	1978	1980	1976	1978	1980
All fields	2,324,500	2,643,300	2,873,700	2,103,500	2,397,500	2,560,100	221,000	245,800	313,600	44,500	27,600	32,300
Men	2,110,700	2,368,500	2,511,100	1,913,700	2,153,100	2,245,300	197,000	215,400	265,800	37,900	23,100	26,800
Women	213,900	274,800	362,600	189,800	244,400	314,800	24,100	30,400	47,600	6,600	4,500	5,500
Physical scientists	196,000	217,600	220,500	168,700	188,800	184,200	27,300	28,800	36,300	4,700	3,800	3,900
Men	174,500	193,600	193,700	152,000	170,300	162,800	22,500	23,300	30,900	4,000	3,000	3,100
Women	21,500	24,000	26,900	16,700	18,500	21,400	4,800	5,500	5,500	700	800	800
Mathematical scientists	87,800	98,500	118,700	78,000	88,600	106,600	9,800	9,900	12,100	2,400	800	1,100
Men	74,300	82,600	95,800	66,100	75,000	86,900	8,200	7,600	8,900	1,900	400	600
Women	13,500	15,800	23,000	11,900	13,700	19,700	1,600	2,100	3,300	400	400	500
Computer specialists	201,500	298,000	345,500	193,300	285,900	325,000	8,200	12,100	20,500	2,600	1,600	2,000
Men	168,300	235,300	255,600	161,000	224,200	249,700	7,300	11,100	5,900	1,600	1,400	1,800
Women	33,200	62,700	89,900	32,300	61,700	75,400	900	1,000	14,500	1,000	200	300
Environmental scientists	64,700	81,000	92,000	57,000	69,800	77,900	7,700	11,200	14,100	1,500	1,900	2,400
Men	60,500	73,400	81,300	53,800	64,000	68,900	6,700	9,400	12,400	1,400	1,800	2,100
Women	4,200	7,600	10,700	3,100	5,800	9,000	1,100	1,800	1,700	100	100	300
Engineers	1,168,400	1,303,700	1,387,000	1,076,600	1,199,300	1,238,100	91,800	104,400	148,900	22,900	11,100	13,500
Men	1,157,000	1,284,300	1,354,500	1,065,800	1,181,000	1,207,900	91,200	103,300	146,600	22,700	10,700	12,800
Women	11,400	19,400	32,600	10,800	18,300	30,100	6,000	1,100	2,500	200	400	700
Life scientists	279,000	323,100	377,100	257,700	300,800	349,300	21,300	22,300	27,800	4,000	3,800	4,300
Men	232,500	265,600	298,100	213,900	247,100	275,600	18,600	18,500	22,500	2,200	3,000	3,300
Women	46,500	57,500	79,000	43,800	53,800	73,600	2,700	3,700	5,400	1,800	800	1,000
Psychologists	109,500	118,100	123,000	99,900	104,300	108,500	9,600	13,300	14,500	2,800	1,500	1,700
Men	74,200	77,600	76,000	68,200	69,100	67,400	6,000	8,500	8,600	1,600	900	800
Women	35,400	40,400	47,000	31,700	35,700	41,100	3,700	4,700	5,900	1,200	600	900
Social scientists	217,600	203,300	209,900	172,400	159,500	170,600	45,200	43,800	39,300	3,700	3,000	3,400
Men	169,500	156,100	156,100	132,800	122,400	126,000	36,700	33,700	30,100	2,500	1,800	2,200
Women	48,100	47,300	53,700	39,500	37,000	44,600	8,600	10,300	9,100	1,200	1,100	1,200

NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-4. Engineers by specialty, sex, and employment status: 1976, 1978, and 1980

Field and sex	Total employed									Unemployed, seeking		
	Total			In science/engineering			Outside science/engineering					
	1976	1978	1980	1976	1978	1980	1976	1978	1980	1976	1978	1980
Engineers	1,168,400	1,303,700	1,387,000	1,076,600	1,199,300	1,238,100	91,800	104,400	148,900	22,900	11,100	13,500
Men	1,157,000	1,284,300	1,354,500	1,065,800	1,181,000	1,207,900	91,200	103,300	146,600	22,700	10,700	12,800
Women	11,400	19,400	32,600	10,800	18,300	30,100	6,000	1,100	2,500	200	400	700
Aeronautical/ astronautical	38,600	42,200	46,600	36,600	40,100	42,200	2,000	2,100	4,400	1,100	500	500
Men	38,000	41,400	45,100	36,100	39,300	40,800	1,900	2,100	4,300	1,100	500	500
Women	600	800	1,500	600	800	1,500	(*)	(*)	(*)	(*)	(*)	(*)
Chemical	60,100	65,700	72,400	57,900	62,200	66,300	2,200	3,500	6,100	600	700	800
Men	58,600	63,500	68,800	56,300	60,100	62,900	2,200	3,400	5,900	500	600	700
Women	1,600	2,200	3,600	1,600	2,100	3,400	(*)	100	200	100	100	(*)
Civil	151,000	174,100	187,300	145,800	167,800	174,100	5,200	6,300	13,200	3,100	1,900	2,200
Men	149,200	171,700	183,400	144,200	165,500	170,400	5,000	6,200	13,000	3,000	1,900	2,200
Women	1,800	2,400	3,900	1,500	2,300	3,700	300	100	200	100	(*)	(*)
Electrical/ electronic	193,900	232,700	255,800	182,900	222,200	238,000	11,000	10,500	17,800	3,000	1,600	2,100
Men	193,100	230,900	251,900	182,200	220,500	234,400	10,900	10,400	17,500	3,000	1,600	2,000
Women	800	1,800	3,800	700	1,800	3,600	100	(*)	200	(*)	(*)	(*)
Mechanical	203,500	220,300	233,100	193,800	211,400	216,000	9,700	8,900	17,100	3,900	1,200	1,600
Men	202,300	218,000	229,400	192,700	209,200	212,200	9,600	8,800	17,100	3,900	1,100	1,600
Women	1,200	2,300	3,800	1,100	2,300	3,700	100	(*)	100	(*)	100	(*)
Other	521,300	568,600	591,900	459,500	495,500	501,500	61,800	73,100	90,400	11,200	5,300	6,200
Men	515,800	558,700	575,900	454,300	486,400	487,200	61,500	72,300	88,700	11,200	5,100	5,800
Women	5,500	9,900	16,000	5,200	9,100	14,300	300	800	1,700	(*)	200	400

*Too few cases to estimate.

NOTE: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

Table B-5. Scientists and engineers by field, sex, and type of employer: 1976, 1978, and 1980

Field and sex	Total			Business/industry			Educational institutions			Federal Government			Other[1]		
	1976	1978	1980	1976	1978	1980	1976	1978	1980	1976	1978	1980	1976	1978	1980
All fields	2,324,500	2,643,300	2,873,700	1,274,900	1,565,300	1,706,800	421,900	458,400	505,700	219,200	235,200	248,400	408,500	384,400	412,900
Men	2,110,700	2,368,500	2,511,100	1,214,400	1,465,400	1,563,200	348,200	371,000	397,700	202,700	214,900	220,600	345,300	317,300	329,700
Women	213,900	274,800	362,600	60,600	99,900	143,600	73,700	87,400	108,000	16,600	20,300	27,700	63,000	67,100	83,200
Physical scientists	196,000	217,600	220,500	100,600	114,400	116,900	48,300	54,100	55,900	19,000	20,500	19,600	28,100	28,500	28,100
Men	174,500	193,600	193,700	91,100	103,300	103,900	42,000	47,200	48,400	17,400	17,900	17,000	24,200	25,200	24,200
Women	21,500	24,000	26,900	9,500	11,100	13,000	6,300	6,900	7,500	1,600	2,600	2,600	4,100	3,500	3,800
Mathematical scientists	87,800	98,500	118,700	27,800	33,100	42,000	39,400	44,400	52,200	11,300	11,300	12,600	9,300	9,600	12,000
Men	74,300	82,500	95,800	24,100	27,800	34,100	33,300	37,600	42,500	10,000	9,900	10,800	7,000	7,200	8,300
Women	13,500	15,800	23,000	3,800	5,300	7,900	6,100	6,700	9,600	1,300	1,500	1,800	2,400	2,300	3,600
Computer specialists	201,500	298,000	345,500	142,000	217,800	255,300	18,800	32,300	36,600	15,500	19,800	21,500	25,000	28,100	32,200
Men	168,300	235,300	255,600	119,100	174,100	191,200	15,900	22,600	23,900	12,900	17,000	17,300	20,400	21,700	23,100
Women	33,200	62,700	89,900	22,900	43,800	64,100	3,000	9,800	12,600	2,600	2,800	4,200	4,600	2,500	9,000
Environmental scientists	64,700	81,000	92,000	29,000	40,400	46,500	13,200	15,200	17,000	11,000	13,200	14,400	11,500	12,300	14,200
Men	60,500	73,400	81,300	27,400	36,800	41,400	11,600	13,600	14,800	10,300	12,200	13,000	11,200	10,900	12,000
Women	4,200	7,600	10,700	1,600	3,600	5,100	1,600	1,600	2,200	600	900	1,400	300	1,400	2,100
Engineers	1,168,400	1,303,700	1,387,000	845,300	1,001,400	1,070,800	52,200	57,300	64,500	93,300	99,700	101,600	177,500	145,500	150,100
Men	1,157,000	1,284,300	1,354,500	837,600	986,900	1,045,900	51,200	55,600	61,900	92,500	98,300	99,300	175,600	143,400	147,500
Women	11,400	19,400	32,600	7,700	14,500	24,900	1,000	1,700	2,600	800	1,300	2,300	1,900	1,900	2,700
Life scientists	279,000	323,100	377,100	72,300	91,300	107,000	114,200	130,500	153,200	41,700	44,500	50,400	50,900	56,900	66,600
Men	232,500	265,600	298,100	66,200	80,900	91,500	88,800	101,300	114,900	38,400	40,300	43,700	39,000	42,900	48,000
Women	46,500	57,500	79,000	6,000	10,400	15,500	25,400	29,100	38,300	3,200	4,200	6,700	11,800	13,600	18,400
Psychologists	109,500	118,100	123,000	13,700	19,600	19,300	45,300	48,400	49,000	3,300	3,000	2,800	47,200	47,000	51,800
Men	74,200	77,600	76,000	10,600	14,500	13,600	31,100	32,000	30,500	2,000	1,800	1,700	30,500	29,200	30,200
Women	35,400	40,400	47,000	3,100	5,100	5,800	14,200	16,300	18,400	1,400	1,200	1,200	16,600	17,800	21,600
Social scientists	217,600	203,300	209,900	44,200	47,300	49,000	90,500	76,300	77,400	24,200	23,200	25,500	58,600	56,400	58,000
Men	169,500	156,100	156,100	38,300	41,000	41,600	74,500	61,100	60,700	19,200	17,500	17,800	37,400	36,400	36,000
Women	48,100	47,300	53,700	5,900	6,300	7,400	16,000	15,200	16,700	5,000	5,700	7,600	21,200	20,100	22,000

[1] Includes nonprofit organizations, military, State, local and other government, other, and no report.

NOTE: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

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Table B-6. Scientists and engineers by field, sex, and type of employer: 1980

Field and sex	Total	Business/ industry	Educational institutions	Nonprofit organizations	Federal Government	Military	State and local governments	Other governments	Other	No report
Total, all fields	2,873,700	1,706,800	505,700	134,100	248,400	38,000	202,400	4,200	6,200	28,000
Men	2,511,100	1,563,200	397,700	89,600	220,600	36,200	169,200	3,500	5,400	25,800
Women	362,600	143,600	108,000	44,500	27,700	1,900	33,200	700	800	2,100
Physical scientists	220,500	116,900	55,900	11,700	19,600	2,900	10,700	(1)	700	2,100
Men	193,700	103,900	48,400	9,500	17,000	2,300	9,600	(1)	700	2,100
Women	26,900	13,000	7,500	2,200	2,600	600	1,100	(1)	(1)	(1)
Mathematical scientists	118,700	42,000	52,200	4,500	12,600	1,200	5,000	100	(1)	1,200
Men	95,800	34,100	42,500	3,100	10,800	1,000	3,400	100	(1)	700
Women	23,000	7,900	9,600	1,300	1,800	200	1,600	(1)	(1)	500
Computer specialists	345,500	255,300	36,600	8,600	21,500	5,800	14,600	500	600	2,100
Men	255,600	191,200	23,900	7,000	17,300	5,200	9,200	400	200	1,100
Women	89,900	64,100	12,600	1,600	4,200	600	5,400	(1)	400	1,000
Environmental scientists	92,000	46,500	17,000	1,300	14,400	2,500	9,600	(1)	200	600
Men	81,300	41,400	14,800	1,000	13,000	2,300	7,900	(1)	200	600
Women	10,700	5,100	2,200	300	1,400	200	1,600	(1)	(1)	(1)
Engineers	1,387,000	1,070,800	64,500	20,600	101,600	22,300	84,300	1,500	2,400	19,000
Men	1,354,500	1,045,900	61,900	20,300	99,300	22,100	82,400	1,400	2,400	18,900
Women	32,600	24,900	2,600	300	2,300	200	2,000	100	(1)	100
Life scientists	377,100	107,000	153,200	29,200	50,400	1,800	31,800	500	1,100	2,200
Men	298,100	91,500	114,900	16,600	43,700	1,600	26,500	400	1,000	1,900
Women	79,000	15,500	38,300	12,600	6,700	200	5,200	(1)	100	300
Psychologists	123,000	19,300	49,000	38,300	2,800	1,000	11,900	(1)	500	100
Men	76,000	13,600	30,500	21,700	1,700	900	7,200	(1)	300	100
Women	47,000	5,800	18,400	16,700	1,200	(1)	4,700	(1)	200	(1)
Social scientists	209,900	49,000	77,400	19,900	25,500	600	34,500	1,700	700	600
Men	156,100	41,600	60,700	10,300	17,800	600	22,900	1,100	600	500
Women	53,700	7,400	16,700	9,600	7,600	(1)	11,600	600	100	100

(1) Too few cases to estimate

NOTE: Detail may not add to totals because of rounding

SOURCE: National Science Foundation

Table B-7. Scientists and engineers by field, sex, and primary work activity: 1976, 1978, and 1980

Field and sex	Total			Research			Development			Management[1]			Teaching			Other[2]		
	1976	1978	1980	1976	1978	1980	1976	1978	1980	1976	1978	1980	1976	1978	1980	1976	1978	1980
Total, all fields	2,324,500	2,643,300	2,873,700	250,400	283,700	327,000	376,600	412,200	464,400	606,500	655,000	648,900	229,800	242,400	265,500	861,300	1,050,000	1,167,700
Men	2,110,700	2,368,500	2,511,100	208,900	237,000	265,300	361,900	394,300	437,200	581,100	626,300	615,600	189,100	194,500	205,300	769,600	916,400	987,800
Women	213,900	274,800	362,600	41,400	46,800	61,800	14,700	17,800	27,200	25,400	28,700	33,300	40,700	48,000	60,200	91,700	133,600	180,100
Physical scientists	196,000	217,600	220,500	57,300	65,500	66,300	20,800	27,100	27,400	39,400	41,900	40,400	22,200	24,600	25,700	56,300	58,600	60,800
Men	174,500	193,600	193,700	49,300	56,700	57,500	19,800	25,300	25,200	37,300	39,900	38,400	20,000	21,300	22,000	48,100	50,300	50,700
Women	21,500	24,000	26,900	7,800	8,600	8,800	1,100	1,900	2,200	2,100	2,000	2,000	2,200	3,300	3,800	8,200	8,200	9,900
Mathematical scientists	87,800	98,500	118,700	10,100	10,800	12,500	5,100	5,100	6,200	16,700	17,100	17,800	31,500	35,100	40,100	24,400	30,400	42,100
Men	74,300	82,600	95,800	9,300	9,600	10,900	3,900	4,500	5,300	15,900	15,800	16,100	26,600	29,400	32,400	18,600	23,300	31,100
Women	13,500	15,800	23,000	800	1,200	1,600	1,200	600	900	900	1,300	1,800	4,900	5,600	7,700	5,700	7,000	10,900
Computer specialists	201,500	298,000	345,500	4,300	9,200	[illegible]00	40,300	40,900	47,200	30,700	37,700	38,700	7,100	7,700	8,900	119,100	202,500	240,300
Men	168,300	235,300	255,600	3,600	7,500	[illegible]00	32,300	33,300	36,500	28,400	34,100	34,400	5,500	6,200	7,000	98,400	154,300	170,000
Women	33,200	62,700	89,900	800	1,800	[illegible]400	7,900	7,600	10,700	2,300	3,600	4,300	1,600	1,500	1,900	20,700	48,400	70,500
Environmental scientists	64,700	81,000	92,000	14,900	19,100	21,500	3,500	5,000	6,200	15,000	15,100	15,700	6,800	7,800	8,900	24,600	34,000	39,700
Men	60,500	73,400	81,300	12,800	16,900	18,700	3,400	4,700	5,700	14,800	14,400	14,900	6,100	7,400	8,100	23,600	29,800	33,900
Women	4,200	7,600	10,700	2,100	2,200	2,800	100	300	500	200	700	800	700	400	800	1,100	4,000	5,700
Engineers	1,168,400	1,303,700	1,387,000	51,000	53,500	63,800	296,100	316,900	358,400	356,900	392,100	386,000	27,800	29,800	31,900	436,600	511,400	578,800
Men	1,157,000	1,284,300	1,354,500	48,900	50,900	59,800	293,000	312,900	350,100	355,400	390,100	382,800	27,700	29,300	31,400	432,000	501,000	530,400
Women	11,400	19,400	32,600	2,100	2,500	4,000	3,100	4,100	8,300	1,500	2,000	3,200	100	400	600	4,800	10,300	16,500
Life scientists	279,000	323,100	377,100	76,600	91,800	113,100	8,200	11,400	13,200	66,500	72,100	76,300	45,000	51,300	58,500	82,600	96,600	115,900
Men	232,500	265,600	298,100	57,800	70,000	82,600	7,100	9,500	10,500	63,100	67,800	70,200	34,900	40,300	44,200	69,500	78,000	90,500
Women	46,500	57,500	79,000	18,900	21,800	30,500	1,100	1,900	2,700	3,400	4,300	6,100	10,100	11,000	14,300	13,100	18,500	25,300
Psychologists	109,500	118,100	123,000	10,300	10,300	12,500	700	1,900	1,700	18,700	21,300	20,200	31,900	33,900	37,200	48,000	50,700	51,500
Men	74,200	77,600	76,000	7,200	7,900	8,400	700	1,100	1,000	15,000	16,600	15,100	21,000	20,600	20,800	30,100	31,400	30,700
Women	35,400	40,400	47,000	3,000	2,400	4,000	(3)	800	800	3,700	4,600	5,100	10,900	13,300	16,300	17,700	19,300	20,700
Social scientists	217,600	203,300	209,900	26,000	23,500	27,100	1,800	3,800	4,000	62,700	57,700	53,800	57,500	52,300	54,300	69,700	66,000	70,800
Men	169,500	156,100	156,100	20,100	17,300	19,300	1,600	3,100	3,000	51,300	47,600	43,900	47,200	39,900	39,500	49,300	48,100	50,500
Women	48,100	47,300	53,700	5,800	6,100	7,700	(3)	800	1,100	11,400	10,100	9,900	10,300	12,400	14,800	20,300	17,900	20,300

[1] Includes management of R&D.
[2] Includes consulting, production/inspection, reporting, statistical work, computing, other activities, and no report.
[3] Too few cases to estimate.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation.

Table B-8. Scientists and engineers by field, sex, and primary work activity: 1980

Field and sex	Research and development				Management			Teaching	Consulting	Production/inspection	Reporting, statistical work, computing	Other activities	No report
	Total	Basic research	Applied research	Development	Total	Of R&D	Other R&D						
Total, all fields	2,873,700	158,700	168,300	464,400	648,900	217,500	431,500	265,500	104,100	391,600	418,600	206,000	47,400
Men	2,511,100	120,100	145,100	437,200	615,600	207,100	408,500	205,300	96,600	363,600	316,200	170,600	40,800
Women	362,600	38,600	23,200	27,200	33,300	10,400	23,000	60,200	7,600	28,000	102,400	35,500	6,600
Physical scientists	220,500	34,700	31,700	27,400	40,400	21,800	18,600	25,700	2,600	30,900	9,000	14,100	4,200
Men	193,700	28,800	28,600	25,200	38,400	21,200	17,200	22,000	2,400	26,200	6,600	11,500	4,000
Women	26,900	5,800	3,000	2,200	2,000	700	1,400	3,800	100	4,700	2,300	2,600	200
Mathematical scientists	118,700	6,300	6,200	6,200	17,800	6,700	11,200	40,100	1,900	3,800	32,900	1,700	1,800
Men	95,800	6,100	4,800	5,300	16,100	6,300	9,800	32,400	1,800	3,600	22,800	1,600	1,300
Women	23,000	200	1,400	900	1,800	400	1,400	7,700	100	200	10,100	100	400
Computer specialists	345,500	3,600	6,700	47,200	38,700	14,400	24,300	8,900	12,800	11,800	199,300	9,500	6,900
Men	255,600	2,700	5,200	36,500	34,400	12,800	21,600	7,000	10,300	9,700	138,500	8,100	3,400
Women	89,900	900	1,500	10,700	4,300	1,600	2,700	1,900	2,500	2,100	60,900	1,400	3,600
Environmental scientists	92,000	7,900	13,600	6,200	15,700	5,100	10,600	8,900	4,400	13,800	14,000	6,300	1,200
Men	81,300	6,800	11,900	5,700	14,900	4,600	10,300	8,100	4,200	11,600	11,500	5,400	1,200
Women	10,700	1,100	1,600	500	800	600	300	800	200	2,100	2,500	900	(1)
Engineers	1,387,000	16,100	47,700	358,400	386,000	124,200	261,800	31,900	63,900	265,000	105,100	89,000	23,900
Men	1,354,500	14,600	45,100	350,100	382,800	122,900	259,800	31,400	63,100	257,700	98,500	87,400	23,700
Women	32,600	1,400	2,600	8,300	3,200	1,200	2,000	600	800	7,400	6,600	1,500	200
Life scientists	377,100	70,100	43,000	13,200	76,300	21,600	54,600	58,500	7,000	51,700	22,600	30,800	3,800
Men	298,100	46,900	35,800	10,500	70,200	20,000	50,200	44,200	6,400	43,000	16,200	21,600	3,300
Women	79,000	23,200	7,300	2,700	6,100	1,600	4,500	14,300	600	8,700	6,400	9,100	500
Psychologists	123,000	6,800	5,700	1,700	20,200	7,800	12,400	37,200	5,500	4,600	7,500	33,300	600
Men	76,000	4,100	4,300	1,000	15,100	6,000	9,100	20,800	3,800	3,200	3,500	19,800	400
Women	47,000	2,600	1,400	800	5,100	1,800	3,300	16,300	1,600	1,400	4,000	13,400	300
Social scientists	209,900	13,200	13,800	4,000	53,800	15,800	38,000	54,300	6,100	10,100	28,300	21,400	4,900
Men	156,100	9,900	9,500	3,000	43,900	13,300	30,600	39,500	4,500	8,700	18,600	15,200	3,500
Women	53,700	3,300	4,300	1,100	9,900	2,500	7,500	14,800	1,600	1,400	9,700	6,200	1,400

(1) Too few cases to estimate.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-9. Median annual salaries of 1972 science/engineering degree recipients by field and level of highest degree: 1978

Field	Bachelor's	Master's	Doctorate
Total	$18,200	$19,600	$19,500
Physical sciences	16,200	17,700	20,500
Mathematical sciences	16,700	20,400	(1)
Engineering	20,400	21,200	(1)
Life sciences	15,100	15,100	(1)
Social sciences	14,900	16,100	18,400

(1) Too few cases to estimate.
SOURCE: National Science Foundation

Table B-10. Median annual salaries of experienced scientists and engineers by sex and race: 1974, 1976, and 1978

Sex and race	1974	1976	1978
Total	$19,300	$23,000	$27,200
Sex:			
Men	19,400	23,100	27,400
Women	15,700	19,000	22,600
Race:			
White	19,400	23,000	27,300
Black	18,200	21,700	24,900
Asian	NA	22,300	25,800
Other	NA	19,800	24,300

NOTE: NA—Not available.
SOURCE: National Science Foundation

Table B-11. Unemployment rates: 1976-80

Year	Scientists and engineers	Professional and related workers	Total labor force
1976	1.9	3.2	7.7
1977	NA	3.0	7.1
1978	1.0	2.6	6.1
1979	NA	2.4	5.8
1980	1.1	2.5	7.1

SOURCES: Department of Labor and National Science Foundation

Table B-12. Scientists and engineers by field, labor force status, and race: 1976, 1978, and 1980

Field and race	Total			Labor force			Outside labor force		
	1976	1978	1980	1976	1978	1980	1976	1978	1980
Total, all fields	2,523,600	2,873,500	3,110,700	2,369,000	2,671,000	2,906,000	154,600	202,600	204,800
White	2,415,300	2,742,000	2,959,700	2,264,000	2,545,100	2,762,600	151,300	196,900	197,100
Black	37,600	49,900	59,500	35,800	47,000	55,900	1,800	2,800	3,500
Asian	57,900	72,000	81,000	56,900	69,500	77,200	1,100	2,500	3,800
Other[1]	12,700	9,700	10,500	12,400	9,300	10,200	400	300	400
Physical scientists	223,600	255,100	261,900	200,700	221,400	224,400	22,900	33,700	37,500
White	210,600	240,200	246,400	188,200	207,500	210,700	22,400	32,700	35,700
Black	4,700	5,300	5,600	4,600	4,800	4,800	100	500	800
Asian	7,200	9,300	9,500	7,000	8,800	8,500	300	500	1,000
Other	1,100	300	400	900	200	300	200	[2]	100
Mathematical scientists	96,000	106,000	127,000	90,200	99,300	119,800	5,800	6,800	7,200
White	88,000	98,000	117,800	82,500	91,500	110,900	5,400	6,500	6,800
Black	5,100	4,800	5,000	4,800	4,600	4,800	300	200	200
Asian	2,600	2,900	3,800	2,600	2,800	3,600	100	100	200
Other	300	400	500	300	400	500	[2]	[2]	[2]
Computer specialists	209,500	306,800	354,900	204,100	299,600	347,500	5,400	7,100	7,400
White	199,300	289,700	333,200	194,100	283,000	326,300	5,300	6,700	6,900
Black	3,500	5,400	7,600	3,400	5,200	7,400	100	200	200
Asian	5,100	11,200	13,100	5,000	10,900	12,900	100	300	300
Other	1,600	500	900	1,600	500	900	[2]	[2]	[2]
Environmental scientists	70,800	89,700	102,600	66,300	82,900	94,400	4,600	6,700	8,200
White	68,700	87,700	100,500	64,200	81,200	92,500	4,600	6,500	8,000
Black	700	500	600	700	400	500	[2]	100	100
Asian	1,200	1,000	1,100	1,200	900	1,000	[2]	100	100
Other	200	500	500	200	500	500	[2]	[2]	[2]
Engineers	1,266,700	1,415,500	1,497,100	1,191,300	1,314,900	1,400,500	75,400	100,600	96,600
White	1,219,600	1,360,200	1,432,900	1,144,800	1,260,800	1,338,500	74,800	99,400	94,400
Black	11,400	14,800	18,900	11,200	14,300	18,100	200	500	900
Asian	29,500	35,300	40,000	29,100	34,700	38,800	400	600	1,200
Other	6,200	5,300	5,300	6,200	5,100	5,100	[2]	200	200
Life scientists	298,300	349,400	404,700	282,900	326,900	381,300	15,400	22,500	23,400
White	285,100	332,500	385,500	270,100	310,900	363,100	14,900	21,500	22,300
Black	4,400	6,400	7,500	4,400	6,200	7,300	[2]	200	200
Asian	7,300	9,000	9,900	7,000	8,300	9,200	300	700	700
Other	1,500	1,600	1,800	1,400	1,500	1,800	100	[2]	100
Psychologists	118,200	127,400	132,600	112,300	119,600	124,700	5,900	7,800	7,900
White	113,700	122,900	128,100	107,800	115,400	120,400	5,900	7,600	7,700
Black	3,100	3,600	3,600	3,100	3,400	3,300	[2]	200	200
Asian	500	400	600	500	400	600	[2]	[2]	[2]
Other	900	400	300	900	400	300	[2]	[2]	[2]
Social scientists	240,500	223,700	229,700	221,300	206,300	213,200	19,100	17,400	16,500
White	230,200	210,900	215,300	212,200	194,800	200,000	18,000	16,100	15,300
Black	4,700	9,100	10,600	3,600	8,100	9,800	1,100	1,000	800
Asian	4,500	3,000	2,900	4,500	2,700	2,600	[2]	200	300
Other	1,000	800	900	1,000	700	800	[2]	100	100

[1] Includes American Indians, other, and no report.
[2] Too few cases to estimate.

NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-13. Scientists and engineers by field, employment status, and race: 1976, 1978, and 1980

Field and race	Total employed			Employed in science/engineering			Employed in nonscience/engineering			Unemployed, seeking employment		
	1976	1978	1980	1976	1978	1980	1976	1978	1980	1976	1978	1980
Total, all fields	2,324,500	2,643,300	2,873,700	2,103,500	2,397,500	2,560,100	221,000	245,800	313,600	44,500	27,600	32,300
White	2,222,100	2,519,000	2,732,800	2,009,200	2,283,200	2,432,600	212,900	235,800	300,200	41,900	26,100	29,800
Black	34,400	46,600	54,700	30,500	41,000	47,500	3,900	5,600	7,200	1,400	400	1,200
Asian	56,200	68,400	75,900	53,200	65,200	71,200	3,000	3,200	4,700	700	1,100	1,300
Other[1]	11,900	9,300	10,200	10,600	8,100	8,800	1,300	1,200	1,400	500	[2]	[2]
Physical scientists	196,000	217,600	220,500	168,700	188,800	184,200	27,300	26,800	36,300	4,700	3,800	3,900
White	183,900	204,000	207,100	158,300	177,000	172,800	25,600	27,000	34,300	4,300	3,500	3,600
Black	4,400	4,700	4,700	3,600	3,700	3,600	800	1,000	1,100	200	100	100
Asian	6,700	8,600	8,300	6,100	7,900	7,600	600	700	700	300	200	200
Other	900	200	300	800	100	200	100	100	100	[2]	[2]	[2]
Mathematical scientists	87,800	98,500	118,700	78,000	88,600	106,600	9,800	9,900	12,100	2,400	800	1,100
White	80,100	90,700	109,800	70,800	81,800	98,700	9,300	8,900	11,100	2,400	800	1,100
Black	4,800	4,600	4,800	4,300	3,700	3,800	500	900	1,000	[2]	[2]	[2]
Asian	2,600	2,800	3,600	2,600	2,800	3,600	[2]	[2]	[2]	[2]	[2]	[2]
Other	300	400	500	300	400	500	[2]	[2]	[2]	[2]	[2]	[2]
Computer specialists	201,500	298,000	345,500	193,300	285,900	325,000	8,200	12,100	20,500	2,600	1,600	2,000
White	192,100	281,800	324,900	184,500	270,200	305,500	7,600	11,600	19,400	2,000	1,200	1,400
Black	2,800	5,200	7,200	2,500	5,100	6,600	300	100	600	600	[2]	200
Asian	5,000	10,500	12,500	4,800	10,200	12,100	200	300	400	[2]	400	400
Other	1,600	500	900	1,500	500	800	100	[2]	100	[2]	[2]	[2]
Environmental scientists	64,700	81,000	92,000	57,000	69,800	77,900	7,700	11,200	14,100	1,500	1,900	2,400
White	62,800	79,300	90,100	55,200	68,400	76,300	7,600	10,900	13,800	1,400	1,900	2,400
Black	600	400	500	400	400	400	200	[2]	100	100	[2]	[2]
Asian	1,100	800	900	1,100	600	700	[2]	200	200	100	100	100
Other	200	500	500	200	500	400	[2]	[2]	100	[2]	[2]	[2]
Engineers	1,168,400	1,303,700	1,387,000	1,076,600	1,199,300	1,238,100	91,800	104,400	148,900	22,900	11,100	13,500
White	1,123,000	1,249,900	1,325,600	1,034,500	1,148,300	1,181,200	88,500	101,600	144,400	21,800	10,900	12,900
Black	10,800	14,300	18,000	9,700	13,700	16,800	1,100	600	1,200	400	[2]	100
Asian	28,900	34,500	38,400	27,300	32,900	35,800	1,600	1,600	2,600	200	200	400
Other	5,800	5,100	5,100	5,100	4,400	4,200	700	700	900	400	[-]	[2]
Life scientists	279,000	323,100	377,100	257,700	300,800	349,300	21,300	22,300	27,800	4,000	3,800	4,300
White	266,200	307,100	358,900	245,400	285,700	332,300	20,800	21,400	26,600	3,900	3,800	4,200
Black	4,400	6,200	7,300	4,200	5,600	6,500	200	600	800	[2]	[2]	[2]
Asian	6,900	8,200	9,100	6,900	8,100	8,700	[2]	100	400	100	100	100
Other	1,400	1,500	1,800	1,200	1,500	1,500	200	[2]	100	[2]	[2]	[2]
Psychologists	109,500	118,100	123,000	99,900	104,800	108,500	9,600	13,300	14,500	2,800	1,500	1,700
White	105,200	114,100	119,000	96,000	101,200	105,000	9,200	12,900	14,000	2,600	1,300	1,400
Black	3,100	3,200	3,000	3,000	3,100	2,800	100	100	200	[2]	200	300
Asian	500	400	600	400	400	500	100	[2]	100	[2]	[2]	[2]
Other	700	400	300	500	200	100	200	200	200	200	[2]	[2]
Social scientists	217,600	203,300	209,900	172,400	159,500	170,600	45,200	43,800	39,300	3,700	3,000	3,400
White	208,600	192,100	197,200	164,400	150,700	160,800	44,200	41,400	36,400	3,600	2,700	2,800
Black	3,500	7,900	9,400	2,900	5,800	6,900	600	2,100	2,500	100	200	400
Asian	4,500	2,600	2,500	4,000	2,400	2,200	500	200	300	[2]	100	100
Other	1,000	700	800	1,000	600	700	[2]	100	100	[2]	[2]	[2]

[1] Includes American Indians, other, and no report.
[2] Too few cases to estimate.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-14. Characteristics of the total population of doctoral scientists and engineers in the United States: 1973, 1977, and 1979

Characteristics	1973		1977		1979	
	Number	Percent	Number	Percent	Number	Percent
Total	238,913	100.0	303,267	100.0	332,280	100.0
Field:						
Physical scientists	53,012	22.2	62,044	20.5	64,318	19.4
Chemists	33,920	14.2	40,639	13.4	42,654	12.8
Physicists/astronomers	19,092	8.0	21,405	7.1	21,664	6.5
Mathematical scientists	13,084	5.5	15,406	5.1	16,060	4.8
Mathematicians	11,581	4.8	13,665	4.5	13,642	4.1
Statisticians	1,503	.6	1,741	.6	2,418	.7
Computer specialists	2,726	1.1	5,822	1.9	6,758	2.0
Environmental scientists	10,926	4.6	13,543	4.5	15,078	4.5
Earth scientists	9,074	3.8	10,235	3.4	11,587	3.5
Oceanographers	1,196	.5	1,592	.5	1,685	.5
Atmospheric scientists	656	.3	1,716	.6	1,806	.5
Engineers	37,261	15.6	46,539	15.3	51,532	15.5
Life scientists	63,583	26.6	78,346	25.8	86,322	26.0
Biological scientists	40,673	17.0	46,792	15.4	50,012	15.1
Agricultural scientists	11,408	4.8	15,062	5.0	16,093	4.8
Medical scientists	11,502	4.8	16,492	5.4	20,217	6.1
Psychologists	27,151	11.4	35,718	11.8	40,262	12.1
Social scientists	31,170	13.0	45,849	15.1	51,950	15.6
Economists	9,316	3.9	11,689	3.9	12,512	3.8
Sociologists/anthropologists	7,219	3.0	10,352	3.4	11,053	3.3
Other social scientists	14,635	6.1	23,808	7.9	28,385	8.5
Sex:						
Men	218,042	91.3	271,594	89.6	294,371	88.6
Women	20,871	8.7	31,673	10.4	37,905	11.4
Race:						
White	217,112	90.9	270,550	89.2	293,491	88.3
Black	2,242	.9	2,865	.9	3,707	1.1
American Indian	435	.2	659	.2	964	.3
Asian	9,619	4.0	15,789	5.2	21,694	6.5
No report	9,505	4.0	13,404	4.4	12,424	3.7

Table B-14. Characteristics of the total population of doctoral scientists and engineers in the United States: 1973, 1977, and 1979—Con.

Characteristics	1973		1977		1979	
	Number	Percent	Number	Percent	Number	Percent
Age:						
Under 30	10,145	4.2	8,865	2.9	7,891	2.4
30-34	52,088	21.8	55,481	18.3	54,663	16.5
35-39	43,609	18.3	66,745	22.7	77,415	23.3
40-44	36,760	15.4	46,273	15.3	55,129	16.6
45-49	31,257	13.1	38,688	12.8	40,726	12.3
50-54	25,307	10.6	31,942	10.5	33,899	10.2
55-59	16,802	7.0	23,831	7.9	27,524	8.3
60-64	10,476	4.4	14,844	4.9	17,812	5.4
65 and over	12,054	5.0	14,142	4.7	16,646	5.0
No report	415	.2	456	.2	575	.2
Employment status:						
Full-time employed	208,447	87.2	267,073	88.1	292,855	88.1
Science/engineering	195,142	81.7	245,271	80.9	268,164	80.7
Other/unknown field	13,305	5.6	21,802	7.2	24,691	7.4
Part-time employed	6,287	2.6	7,484	2.5	10,683	3.2
Science/engineering	5,450	2.3	6,349	2.1	8,986	2.7
Other/unknown field	837	.4	1,135	.4	1,697	.5
Postdoctorates	5,676	2.4	9,755	3.2	10,198	3.1
Unemployed/seeking	2,514	1.1	3,312	1.1	2,928	.9
Not employed/not seeking	1,454	.6	2,834	.9	3,567	1.1
Retired	6,962	2.9	9,754	3.2	10,349	3.1
Other	2,305	1.0	540	.2	847	.3
No report	5,268	2.2	2,515	.8	853	.3

NOTE: Percents may not add to 100 because of rounding.
SOURCE: National Science Foundation

Table B-15. Selected characteristics of employed doctoral scientists and engineers in the United States: 1973, 1977, and 1979

Characteristics	1973			1977			1979		
	Number	Percent	Median annual salary	Number	Percent	Median annual salary	Number	Percent	Median annual salary
Total	220,410	100.0	$20,700	284,312	100.0	$25,600	313,736	100.0	$29,100
Field									
Physical scientists	48,470	22.0	21,000	57,462	20.2	26,600	60,170	19.2	30,300
Chemists	30,704	13.9	21,000	37,318	13.1	26,600	39,569	12.6	30,400
Physicists/astronomers	17,766	8.1	21,000	20,144	7.1	26,500	20,601	6.6	30,100
Mathematical scientists	12,145	5.5	19,200	14,588	5.1	23,300	15,297	4.9	26,300
Mathematicians	10,686	4.8	19,000	12,875	4.5	23,100	12,930	4.1	26,100
Statisticians	1,459	.7	20,900	1,713	.6	25,100	2,367	.8	29,300
Computer specialists	2,692	1.2	21,700	5,767	2.0	25,800	6,739	2.1	28,500
Environmental scientists	10,325	4.7	20,700	13,026	4.6	25,800	14,609	4.7	30,300
Earth scientists	8,556	3.9	20,700	9,765	3.4	25,900	11,144	3.6	30,300
Oceanographers	1,130	.5	19,700	1,563	.5	24,100	1,662	.5	28,800
Atmospheric scientists	639	.3	22,500	1,698	.6	28,300	1,803	.6	31,300
Engineers	35,775	16.2	22,300	45,046	15.8	28,600	50,222	16.0	33,100
Life scientists	58,047	26.3	20,100	71,939	25.3	24,700	80,090	25.5	28,100
Biological scientists	36,859	16.7	19,400	42,165	14.8	23,800	45,746	14.6	26,500
Agricultural scientists	10,553	4.8	19,900	14,293	5.0	24,800	15,061	4.8	28,000
Medical scientists	10,635	4.8	22,700	15,481	5.4	28,000	19,283	6.1	30,900
Psychologists	24,850	11.3	20,200	33,743	11.9	24,100	37,987	12.1	26,700
Social scientists	28,106	12.8	20,300	42,741	15.0	24,100	48,622	15.5	26,200
Economists	8,289	3.8	22,200	10,792	3.8	27,000	11,718	3.7	31,000
Sociologists/anthropologists	6,530	3.0	19,300	9,493	3.3	22,200	10,224	3.3	23,900
Other social scientists	13,287	6.0	19,500	22,456	7.9	23,200	26,680	8.5	25,300
Sex									
Men	203,452	92.3	21,000	256,808	90.3	26,000	280,393	89.4	29,900
Women	16,958	7.7	17,300	27,504	9.7	20,700	33,343	10.6	23,100
Race									
White	200,878	91.1	20,800	253,582	89.2	25,700	276,872	88.2	29,200
Black	2,089	.9	20,900	2,770	1.0	23,800	3,420	1.1	26,600
American Indian	390	.2	19,200	623	.2	24,100	926	.3	25,800
Asian	9,144	4.1	19,600	15,324	5.4	23,800	21,031	6.7	28,200
No report	7,909	3.6	20,300	12,013	4.2	25,700	11,487	3.7	29,800
Age									
Under 30	9,664	4.4	15,400	8,476	3.0	18,500	7,476	2.4	21,300
30-34	49,717	22.6	17,300	53,582	18.8	20,400	52,703	16.8	22,800
35-39	42,069	19.1	19,600	66,724	23.5	23,600	75,887	24.2	26,600
40-44	35,318	16.0	21,800	45,146	15.9	26,500	54,296	17.3	30,200
45-49	29,938	13.6	24,100	37,672	13.3	29,200	39,860	12.7	32,000
50-54	24,109	10.9	24,900	30,935	10.9	30,900	33,104	10.6	34,100
55-59	15,581	7.1	25,200	22,533	7.9	31,500	26,501	8.4	36,100
60-64	8,987	4.1	25,500	12,964	4.6	31,400	15,438	4.9	36,000
65 and over	4,876	2.2	24,700	5,974	2.1	31,200	7,951	2.5	36,300
No report	151	.1	24,200	306	.1	26,800	520	.2	23,100

Table B-15. Selected characteristics of employed doctoral scientists and engineers in the United States: 1973, 1977, and 1979—Con.

Characteristics	1973			1977			1979		
	Number	Percent	Median annual salary	Number	Percent	Median annual salary	Number	Percent	Median annual salary
Type of employment									
Science/engineering	206,230	93.6	20,700	261,099	91.8	25,500	287,082	91.5	29,000
Other/unknown field	14,180	6.4	22,600	23,213	8.2	27,200	26,654	8.5	30,600
Sector of employment									
Business/industry	53,403	24.2	23,300	71,475	25.1	29,900	82,824	26.4	33,800
Educational institutions	129,408	58.7	19,100	163,140	57.4	23,700	173,966	55.4	26,400
4-year colleges/universities	124,901	56.7	19,200	156,491	55.0	23,800	166,985	53.2	26,400
2-year colleges	2,962	1.3	17,800	4,634	1.6	20,900	4,512	1.4	24,600
Elementary/secondary schools	1,545	.7	19,300	2,015	.7	22,400	2,469	.8	25,800
Hospitals/clinics	4,543	2.1	19,400	8,587	3.0	23,600	9,706	3.1	26,200
Nonprofit organizations	8,006	3.6	21,700	10,198	3.6	26,800	12,549	4.0	30,300
Federal government	18,200	8.3	23,500	21,368	7.5	29,700	23,923	7.6	33,400
Military/Commissioned corps	1,977	.9	(1)	2,282	.8	(1)	2,304	.7	(1)
State government	3,001	1.4	19,400	3,783	1.3	21,600	4,175	1.3	23,500
Other government	1,255	.6	19,000	1,545	.5	22,100	1,943	.6	23,800
Other	331	.2	21,000	584	.2	37,500	945	.3	42,700
No report	286	.1	(1)	1,350	.5	(1)	1,401	.4	(1)
Primary work activity									
Research and development	71,460	32.4	20,5[illegible]	93,477	32.9	25,600	99,701	31.8	29,200
Basic research	34,258	15.5	19,9[illegible]	43,549	15.3	24,600	47,864	15.3	[illegible],700
Applied research	28,700	13.0	20,800	36,426	12.8	26,300	36,842	11.7	30,000
Development	8,502	3.9	20,800	13,502	4.7	26,100	14,995	4.8	30,800
Management/administration[2]	46,172	20.9	26,000	60,478	21.3	31,900	72,224	23.0	35,000
Of R&D	26,223	11.9	26,200	30,737	10.8	33,100	43,042	13.7	35,900
Of other	19,949	9.1	25,700	29,741	10.5	30,600	29,182	9.3	32,400
Teaching	80,012	36.3	18,600	90,413	31.8	22,600	91,922	29.3	25,200
Consulting	4,055	1.8	22,500	6,141	2.2	28,200	8,998	2.9	31,300
Sales/professional services	8,064	3.7	20,600	15,194	5.3	24,700	21,049	6.7	29,000
Other	6,959	3.2	20,600	12,785	4.5	24,700	15,679	5.0	30,100
No report	3,688	1.7	21,600	5,824	2.0	25,400	4,163	1.3	29,900
Federal support status									
Receiving support	99,558	45.2	21,400	119,654	42.1	26,500	126,496	40.3	30,200
No support	110,905	50.3	20,400	152,706	53.7	25,000	170,726	54.4	28,500
Status unknown	6,846	3.1	17,900	7,487	2.6	21,700	9,207	2.9	24,700
No report	3,101	1.4	22,600	4,465	1.6	24,700	7,307	2.3	30,800

[1] No median computed for groups with fewer than 20 individuals reporting salary.

[2] The classification of "management/administration" activities was changed in 1979.

NOTE: Percents may not add to 100 because of rounding. Median salaries computed for full-time employed civilians only.

SOURCE: National Science Foundation.

Table B-16. Selected characteristics of doctoral scientists and engineers by labor force participation and unemployment rates: 1973, 1977, and 1979

Selected characteristics	1973			1977			1979		
	Labor force	Participation rate	Unemployment rate	Labor force	Participation rate	Unemployment rate	Labor force	Participation rate	Unemployment rate
Total, all fields	220,900	93.1	1.1	287,500	94.8	1.2	316,700	95.3	0.9
Physical scientists	49,300	93.1	1.8	58,200	93.8	1.3	60,900	94.6	1.2
Mathematical scientists	12,300	94.1	1.4	14,700	95.7	1.2	15,400	95.7	.4
Computer specialists	2,700	98.8	(*)	5,800	99.1	(*)	6,700	99.7	(*)
Environmental scientists	10,400	95.5	1.0	13,100	96.9	.7	14,700	97.2	.3
Engineers	36,000	96.7	.7	45,300	97.4	.6	50,500	98.0	.5
Life scientists	58,600	92.2	1.0	72,900	93.1	1.4	81,000	93.8	1.1
Psychologists	25,100	92.5	1.0	34,100	95.6	1.2	38,400	95.4	1.1
Social scientists	28,400	91.1	1.0	43,300	94.5	1.4	49,200	94.6	1.1
Sex:									
Men	205,300	94.2	.9	259,100	95.4	.9	282,400	95.9	.7
Women	17,600	84.4	3.8	28,500	89.9	3.4	34,300	90.4	2.7
Race:									
White	202,900	93.6	1.1	256,200	94.8	1.1	279,300	95.2	.9
Racial minorities	11,500	96.1	1.6	18,900	98.3	1.5	25,700	97.6	1.3
Black	2,000	93.0	(*)	2,800	97.0	.7	3,500	94.9	2.8
American Indian	400	94.4	4.0	600	98.3	3.6	900	97.2	1.2
Asian	9,200	96.9	1.8	15,500	98.6	1.5	21,300	98.0	1.1
No report	8,500	(*)	(*)	12,500	(*)	(*)	11,600	93.7	1.3

(*) Too few cases to estimate.

NOTE: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

Table B-17. Employed doctoral scientists and engineers by field and type of employer: 1973, 1977, and 1979

Field	Educational institutions			Business/industry			Federal Government		
	1973	1977	1979	1973	1977	1979	1973	1977	1979
Total, all fields	129,400	163,100	174,000	53,400	71,500	82,800	18,200	21,400	23,900
Physical scientists	22,000	27,100	27,200	19,700	23,000	25,000	4,100	3,900	4,600
Mathematical scientists	10,500	12,200	12,600	900	1,300	1,400	500	600	800
Computer specialists	1,400	2,100	2,500	1,000	3,100	3,700	100	300	300
Environmental scientists	5,200	6,300	6,200	2,200	3,100	4,200	2,000	2,400	2,700
Engineers	13,000	15,900	17,000	17,800	22,900	26,400	2,700	3,500	3,600
Life scientists	39,200	47,500	52,200	7,200	10,100	11,500	6,100	6,800	7,500
Psychologists	15,100	18,600	19,900	3,100	5,500	7,100	1,200	1,200	1,100
Social scientists	23,000	33,400	36,300	1,600	2,600	3,500	1,500	2,600	3,300
	Percent distribution								
Total, all fields	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Physical scientists	17.0	16.6	15.6	36.8	32.2	30.2	22.5	18.5	19.2
Mathematical scientists	8.1	7.5	7.2	1.6	1.8	1.7	2.7	2.8	3.3
Computer specialists	1.1	1.3	1.4	1.9	4.3	4.5	.7	1.2	1.3
Environmental scientists	4.0	3.9	3.6	4.1	4.3	5.1	10.8	11.5	11.3
Engineers	10.1	9.8	9.8	33.3	32.0	31.9	15.0	16.5	15.1
Life scientists	30.3	29.1	30.0	13.6	14.1	13.9	33.6	31.7	31.4
Psychologists	11.7	11.4	11.4	5.8	7.7	8.6	6.8	5.8	4.6
Social scientists	17.8	20.5	20.9	3.0	3.6	4.2	8.0	12.4	13.8

NOTE: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

Table B-18. Doctoral scientists and engineers by primary work activity and type of employer: 1973, 1977, and 1979

Primary work activity	Educational institutions			Business/industry			Federal Government		
	1973	1977	1979	1973	1977	1979	1973	1977	1979
Total	129,400	163,100	174,000	53,400	71,500	82,800	18,200	21,400	23,900
Research and development	30,700	42,600	46,800	23,800	31,300	30,800	10,000	10,800	12,100
Basic research	22,500	30,000	33,200	3,500	4,600	4,700	4,700	4,700	5,400
Applied research	7,600	11,100	12,500	13,200	16,500	14,300	4,800	5,200	5,700
Development	600	1,500	1,100	7,000	10,200	11,800	500	900	1,100
Management/administration	13,600	20,000	26,500	19,800	23,900	27,900	6,200	7,700	8,400
Of R&D	4,500	6,100	8,300	14,200	15,900	23,800	4,500	5,400	6,700
Other than R&D	6,200	10,100	18,200	3,500	6,100	4,100	1,000	1,500	1,700
Of both	2,900	3,800	[2]	2,100	1,900	[2]	700	700	[2]
Teaching	78,900	89,300	90,900	200	200	200	200	200	200
Other[1]	6,100	11,200	9,800	9,600	15,900	24,000	1,700	2,700	3,200
	Percent distribution								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Research and development	23.7	26.1	26.9	44.5	43.9	37.2	55.0	50.8	50.6
Basic research	17.4	18.4	19.1	6.6	6.5	5.7	26.0	22.1	22.6
Applied research	5.9	6.8	7.2	24.7	23.1	17.3	26.4	24.4	23.9
Development	.5	.9	.6	13.1	14.2	14.3	2.6	4.3	4.6
Management/administration	10.5	12.3	15.2	37.2	33.5	33.7	34.0	35.9	35.2
Of R&D	3.5	3.8	4.8	26.7	22.3	28.7	24.7	25.3	28.0
Other than R&D	4.8	6.2	10.5	6.5	8.6	5.0	5.7	7.2	7.1
Of both	2.2	2.3	[2]	4.0	2.6	[2]	3.6	3.4	[2]
Teaching	61.0	54.7	52.2	.4	.3	.2	1.4	.7	.8
Other[1]	4.7	6.8	5.6	18.0	22.3	29.0	9.6	12.6	13.4

[1] Includes consulting, sales/professional services, other, and no report.
[2] Data not separately identifiable from research and development in the other R&D category.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-19. Percent of 1977 cohort of science/engineering doctorate recipients primarily engaged in R&D activities by type of employer: 1979

Type of employer	Total employed	Research and development[1]	Percent
Total	15,835	8,268	52.2
Business/industry	3,497	2,476	70.8
Educational institutions	9,033	4,161	46.1
Federal Government	1,048	790	75.4
Other[2]	2,257	841	37.3

[1] Includes management of R&D.
[2] Includes hospitals/clinics; nonprofit organizations; State and other government; other; and no report.
SOURCE: National Science Foundation

Table B-20. Selected characteristics of employed women doctoral scientists and engineers in the United States: 1973, 1977, and 1979

Characteristics	1973				1977				1979			
	Number	Percent	Percent of total employed	Median annual salary	Number	Percent	Percent of total employed	Median annual salary	Number	Percent	Percent of total employed	Median annual salary
Total	16,958	100.0	7.7	$17,300	27,504	100.0	9.7	$20,700	33,343	100.0	10.6	$23,100
Field												
Physical scientists	1,897	11.2	3.9	17,400	2,908	10.6	5.1	21,200	3,123	9.4	5.2	24,400
Chemists	1,461	8.6	4.8	17,200	2,354	8.6	6.3	20,900	2,546	7.6	6.4	24,200
Physicists/astronomers	436	2.6	2.5	17,600	554	2.0	2.8	23,100	577	1.7	2.8	25,400
Mathematical scientists	775	4.6	6.4	16,600	1,048	3.8	7.2	19,900	1,138	3.4	7.4	21,700
Mathematicians	701	4.1	6.6	16,300	934	3.4	7.3	19,900	977	2.9	7.6	21,800
Statisticians	74	.4	5.1	18,900	114	.4	6.7	19,800	161	.5	6.8	21,600
Computer specialists	88	.5	3.3	17,300	233	.8	4.0	20,800	366	1.1	5.4	22,800
Environmental scientists	262	1.5	2.5	16,700	439	1.6	3.4	19,700	607	1.8	4.2	23,500
Earth scientists	205	1.2	2.4	16,200	293	1.1	3.0	20,000	410	1.2	3.7	25,300
Oceanographers	37	.2	3.3	(1)	75	.3	4.8	19,200	152	.5	9.1	21,500
Atmospheric scientists	20	.1	3.1	(1)	71	.3	4.2	19,200	45	.1	2.5	(1)
Engineers	139	.8	.4	19,600	283	1.0	.6	22,900	527	1.6	1.0	26,600
Life scientists	6,120	36.1	10.5	16,900	8,983	32.7	12.5	21,000	11,142	33.4	13.9	23,000
Biological scientists	4,896	28.9	13.3	16,800	6,684	24.3	15.9	20,500	7,882	23.6	17.2	22,200
Agricultural scientists	131	.8	1.2	16,700	264	1.0	1.8	20,200	320	1.0	2.1	21,600
Medical scientists	1,093	6.4	10.3	18,100	2,035	7.4	13.1	22,800	2,940	8.8	15.2	25,300
Psychologists	4,782	28.2	19.2	18,000	7,645	27.8	22.7	20,600	9,216	27.6	24.3	23,200
Social scientists	2,895	17.1	10.3	17,300	5,965	21.7	14.0	20,200	7,224	21.7	14.9	22,600
Economists	476	2.8	5.7	19,300	790	2.9	7.3	23,600	977	2.9	8.3	26,900
Sociologists/anthropologists	1,227	7.2	18.8	16,600	2,286	8.3	24.1	19,700	2,558	7.7	25.0	22,100
Other social scientists	1,192	7.0	9.0	17,100	2,889	10.5	12.9	19,800	3,689	11.1	13.8	22,300
Race												
White	15,379	90.7	7.7	17,400	24,409	88.7	9.6	20,600	29,225	87.6	10.6	23,000
Black	255	1.5	12.2	18,300	524	1.9	18.9	22,500	785	2.4	23.0	24,100
American Indian	34	.2	8.7	(1)	71	.3	11.4	(1)	117	.4	12.6	21,600
Asian	641	3.8	7.0	16,500	1,319	4.8	8.6	20,500	2,028	6.1	8.6	23,100
No report	649	3.8	8.2	17,400	1,181	4.3	9.8	21,600	1,188	3.6	10.3	24,800
Age												
Under 30	1,026	6.1	10.6	14,500	1,642	6.0	19.4	17,400	1,464	4.4	19.6	18,700
30-34	3,546	20.9	7.1	14,900	6,620	24.1	12.4	18,400	8,450	25.3	16.0	20,600
35-39	2,767	16.3	6.6	16,600	5,640	20.5	8.5	20,000	7,440	22.3	9.8	22,400
40-44	2,445	14.4	6.9	17,900	3,479	12.6	7.7	21,700	4,740	14.2	8.7	24,600
45-49	2,488	14.7	8.3	18,700	3,251	12.0	8.7	23,100	3,345	10.0	8.4	25,500
50-54	1,845	10.9	7.7	19,500	2,887	10.5	9.3	24,700	3,147	9.4	9.5	26,700
55-59	1,381	8.1	8.9	20,200	1,872	6.8	8.3	24,200	2,307	6.9	8.7	28,700
60-64	847	5.0	9.4	20,500	1,241	4.5	9.6	25,000	1,392	4.2	9.0	24,200
65 & over	570	3.4	11.7	19,800	726	2.6	12.2	25,100	913	2.7	11.5	27,900
No report	43	.3	28.5	(1)	106	.4	34.6	(1)	145	.4	27.9	(1)
Type of employment												
Science/engineering	15,551	91.7	7.5	17,300	24,906	90.6	9.5	20,700	29,865	89.6	10.4	23,100
Other/unknown field	1,407	8.3	9.9	18,200	2,596	9.4	11.2	20,500	3,478	10.4	13.0	23,800

Table B-20. Selected characteristics of employed women doctoral scientists and engineers in the United States: 1973, 1977, and 1979—Con.

Characteristics	1973				1977				1979			
	Number	Percent	Percent of total employed	Median annual salary	Number	Percent	Percent of total employed	Median annual salary	Number	Percent	Percent of total employed	Median annual salary
Sector of employment												
Business/industry	1,363	8.0	2.6	20,200	2,959	10.8	4.1	24,400	4,578	13.7	5.5	27,600
Educational institutions	12,160	71.7	9.4	16,800	18,775	68.3	11.5	20,000	21,894	65.7	12.6	22,300
4-year colleges/universities	11,128	65.6	8.9	16,700	17,146	62.3	11.0	20,000	28,073	60.2	12.0	22,200
2-year colleges	549	3.2	18.5	16,700	927	3.4	20.0	19,700	898	2.7	19.9	23,800
Elementary/sec. schools	483	2.8	31.3	19,700	702	2.6	34.8	21,900	923	2.8	37.4	24,300
Hospitals/clinics	967	5.7	21.3	16,600	1,958	7.1	22.8	21,000	1,928	5.8	19.9	22,800
Nonprofit organizations	783	4.6	9.8	17,500	1,445	5.3	14.2	21,100	1,857	5.6	14.8	23,200
Federal government	971	5.7	5.3	21,900	1,273	4.6	6.0	26,600	1,621	4.9	6.8	28,000
Military/commissioned corps	19	.1	1.0	(1)	47	.2	2.1	(1)	52	.2	2.3	(1)
State government	386	2.3	12.9	18,300	495	1.8	13.1	19,500	772	2.3	18.5	20,400
Other government	188	1.1	15.0	16,700	345	1.3	22.3	21,700	397	1.2	20.4	24,200
Other	74	.4	22.4	(1)	23	.1	3.9	(1)	51	.2	5.4	(1)
No report	47	.3	16.4	(1)	184	.7	13.6	(1)	193	.6	13.8	(1)
Primary work activity												
Research and development	4,654	27.4	6.5	17,400	7,596	27.6	8.1	21,000	9,373	28.1	9.4	23,200
Basic research	3,500	20.6	10.2	16,800	5,434	19.8	12.5	20,600	6,404	19.2	13.4	22,200
Applied research	1,004	5.9	3.5	18,900	1,757	6.4	4.8	22,200	2,427	7.3	6.6	25,000
Development	150	.9	1.8	17,100	405	1.5	3.0	20,500	542	1.6	3.6	24,300
Management/administration[2]	1,837	10.8	4.0	20,700	3,438	12.5	5.7	25,100	5,091	15.3	7.0	26,400
Of R&D	704	4.2	2.7	20,900	1,234	4.5	4.0	26,300	2,035	6.1	4.7	27,800
Of other	1,133	6.7	5.7	20,600	2,204	8.0	7.4	24,400	3,056	9.2	10.5	25,400
Teaching	7,504	44.3	9.4	16,500	10,396	37.8	11.5	19,500	11,415	34.2	12.4	21,800
Consulting	333	2.0	8.2	18,200	495	1.8	8.1	22,300	606	1.8	6.7	25,100
Sales/professional services	1,647	9.7	20.4	18,100	3,222	11.7	21.2	21,200	4,378	13.1	20.8	24,500
Other	641	3.8	9.2	17,600	1,652	6.0	12.9	20,500	1,788	5.4	11.4	22,900
No report	342	2.0	9.3	17,200	705	2.6	12.1	20,300	692	2.1	16.6	23,200
Federal support status												
Receiving support	6,782	40.0	6.8	18,000	10,443	38.0	8.7	21,800	12,511	37.5	9.9	23,700
No support	8,858	52.2	8.0	17,000	15,040	54.7	9.8	20,300	18,130	54.4	10.6	22,900
Status unknown	1,058	6.2	15.5	15,800	1,477	5.4	15.7	19,700	1,819	5.5	19.8	21,100
No report	260	1.5	8.4	17,600	544	2.0	12.2	19,200	883	2.6	12.1	23,000

[1] No median computed for groups with fewer than 20 individuals reporting salary.

[2] The classification of "management/administration" activities was changed in 1979.

NOTE: Percents may not add to 100 because of rounding. Median salaries computed for full-time employed civilians only.

SOURCE: National Science Foundation.

Table B-21. Median annual salaries of doctoral scientists and engineers by field and sex: 1979

Field	Total	Men	Women
Total, all fields	29,100	29,900	23,100
Physical scientists	30,300	30,500	24,400
Mathematical scientists	26,300	26,700	21,700
Computer specialists	28,500	28,800	22,800
Environmental scientists	30,300	30,400	23,500
Engineers	33,100	33,200	26,600
Life scientists	28,100	28,900	23,000
Psychologists	26,700	28,000	23,200
Social scientists	26,200	26,800	22,600

SOURCE: National Science Foundation

Table B-22. Median annual salaries of doctoral scientists and engineers by field and type of employer: 1973, 1977, and 1979

Field	Educational institutions			Business/industry			Federal Government		
	1973	1977	1979	1973	1977	1979	1973	1977	1979
Total, all fields	$19,100	$23,700	$26,400	$23,300	$29,900	$33,800	$23,500	$29,700	$33,400
Physical scientists	18,300	23,600	26,500	22,700	29,900	33,100	23,400	29,700	33,200
Mathematical scientists	18,600	22,700	25,500	24,100	27,400	30,800	23,600	29,300	36,300
Computer specialists	21,200	24,400	25,400	22,300	26,700	29,600	22,200	30,500	[1]
Environmental scientists	18,800	23,600	26,700	22,600	28,600	34,000	23,800	30,700	35,300
Engineers	20,600	26,500	30,000	23,300	30,000	35,000	23,400	30,000	35,200
Life scientists	18,900	23,500	26,400	23,300	28,700	33,300	22,800	28,400	32,000
Psychologists	19,200	22,700	25,600	30,000	33,300	38,100	23,800	30,600	34,800
Social scientists	19,500	23,100	25,400	27,500	30,200	32,400	28,000	31,400	34,600

[1] No median computed for groups with fewer than 20 individuals reporting salary.
SOURCE: National Science Foundation

Table B-23. Doctoral scientists and engineers by field and race: 1979

Field	White	Black	Asian
Total, all fields	293,500	3,700	21,700
Physical scientists	56,900	600	4,500
Mathematical scientists	13,900	200	1,000
Computer specialists	6,000	[1]	500
Environmental scientists	14,000	100	500
Engineers	42,100	200	7,700
Life scientists	77,000	1,000	5,100
Psychologists	37,200	600	400
Social scientists	46,400	1,100	2,100

[1] No cases reported.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-24. Doctoral scientists and engineers by type of employer, primary work activity, and race: 1979

Employer/work activity	White	Black	Asian
Type of employer			
Total	276,900	3,400	20,900
Business/industry	70,800	400	8,800
Educational institutions	154,600	2,200	9,900
Federal Government	21,800	400	1,000
Other[1]	28,900	400	1,300
Primary work activity			
Total	276,900	3,400	20,900
Research and development	123,300	1,200	13,300
Teaching	82,100	1,200	4,800
Other[2]	70,800	1,000	2,800

[1] Includes hospitals/clinics; nonprofit organizations, military; State and other government; other; and no report.
[2] Includes consulting, sales/professional services, other, and no report.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation

Table B-25. Bachelor's and first-professional degrees awarded by field: 1960-80

Year	All fields	Science and engineering fields						All other fields[4]
		Total	Physical sciences[1]	Engineering	Mathematical sciences[2]	Life sciences	Social sciences[3]	
	Number							
1960	394,889	120,937	16,057	37,808	11,437	24,141	31,494	273,952
1961	401,784	121,660	15,500	35,866	13,127	23,900	33,267	280,124
1962	420,4[illegible]	127,469	15,894	34,735	14,610	25,200	37,030	293,016
1963	450[illegible]	135,964	16,276	33,458	16,128	27,801	42,308	314,628
1964	50[illegible]	153,361	17,527	35,226	18,677	31,611	50,320	348,743
1965	5[illegible]	164,936	17,916	36,795	19,668	34,842	55,715	373,994
1966	555,613	173,471	17,186	35,815	20,182	36,964	63,424	382,142
1967	594,862	187,849	17,794	36,188	21,530	39,408	72,929	407,013
1968	671,591	212,174	19,442	37,614	24,084	43,260	87,774	459,417
1969	769,683	244,519	21,591	41,553	28,263	48,713	104,399	525,164
1970	833,322	264,122	21,551	44,772	29,109	52,129	116,561	569,200
1971	884,386	271,176	21,549	45,387	27,306	51,461	125,473	613,210
1972	937,884	281,228	20,887	46,003	27,250	51,484	133,604	656,656
1973	980,707	295,391	20,809	46,989	27,528	59,486	140,579	685,316
1974	1,008,654	305,062	21,287	43,530	26,570	68,226	145,449	703,592
1975	987,922	294,920	20,896	40,065	23,385	72,710	137,864	693,002
1976	997,504	292,174	21,559	39,114	21,749	77,301	132,451	705,330
1977	993,008	288,543	22,618	41,581	20,729	78,472	125,143	704,465
1978	997,165	288,167	23,175	47,411	19,925	77,138	120,518	708,998
1979	1,000,5[illegible]2	288,625	23,363	53,720	20,670	75,085	115,787	711,937
1980	1,010,777	291,983	23,661	59,240	22,686	71,617	114,779	718,794
	As a percent of fields							
1960	100	31	4	10	3	6	8	69
1961	100	30	4	9	3	6	8	70
1962	100	30	4	8	4	6	9	70
1963	100	30	4	7	4	6	9	70
1964	100	31	4	7	4	6	10	69
1965	100	31	3	7	4	7	10	69
1966	100	31	3	6	4	7	11	69
1967	100	32	3	6	4	7	12	68
1968	100	32	3	6	4	6	13	68
1969	100	32	3	5	4	6	14	68
1970	100	32	3	5	4	6	14	68
1971	100	31	2	5	3	6	14	69
1972	100	30	2	5	3	6	14	70
1973	100	30	2	5	3	6	14	70
1974	100	30	2	4	3	7	14	70
1975	100	30	2	4	2	7	14	71
1976	100	29	2	4	2	8	13	71
1977	100	29	2	4	2	8	13	71
1978	100	29	2	5	2	8	12	71
1979	100	29	2	5	2	8	12	71
1980	100	29	2	6	2	7	11	71

[1] Including environmental sciences.
[2] Including statistics and computer specialties.
[3] Excluding history and including psychology.
[4] Including first-professional degrees such as M.D., D.D.S., D.V.M., and J.D. degrees.

NOTE: Percents may not add to 100 because of rounding.

SOURCES: National Center for Education Statistics, Department of Education, and National Science Foundation.

Table B-26. Master's degrees awarded by field: 1960-80

Year	All fields	Science and engineering fields						All other fields
		Total	Physical sciences[1]	Engineering	Mathematical sciences[2]	Life sciences	Social sciences[3]	
	Number							
1960	74,497	20,012	3,387	7,159	1,765	3,751	3,950	54,485
1961	78,269	22,786	3,799	8,178	2,238	4,085	4,486	55,483
1962	84,889	25,146	3,929	8,909	2,680	4,672	4,956	59,743
1963	91,418	27,367	4,132	9,635	3,323	4,718	5,559	64,051
1964	101,122	30,271	4,567	10,827	3,603	5,357	5,917	70,851
1965	112,195	33,835	4,918	12,056	4,294	5,978	6,589	78,360
1966	140,772	38,083	4,992	13,678	5,610	6,666	7,737	102,689
1967	157,892	41,800	5,412	13,885	5,733	7,465	9,305	116,092
1968	177,150	45,425	5,508	15,188	6,081	8,315	10,333	131,725
1969	194,414	48,425	5,911	15,243	6,735	8,809	11,727	145,989
1970	209,387	49,318	5,948	15,597	7,107	8,590	12,076	160,069
1971	231,486	50,624	6,386	16,347	6,789	8,320	12,782	180,862
1972	253,774	53,567	6,307	16,802	7,186	8,914	14,358	199,207
1973	264,525	54,234	6,274	16,758	7,146	9,080	14,976	210,291
1974	278,259	54,175	6,087	15,393	7,116	9,605	15,974	224,084
1975	293,651	53,852	5,830	15,434	6,637	9,618	16,333	239,799
1976	313,001	54,747	5,485	16,170	6,466	9,823	16,803	258,254
1977	318,241	56,731	5,345	16,889	6,496	10,707	17,294	261,510
1978	312,816	56,237	5,576	17,105	6,421	10,711	16,514	256,579
1979	302,075	54,456	5,464	16,193	6,101	10,719	15,979	247,619
1980	299,095	54,391	5,233	16,846	6,515	10,278	15,519	244,704
	As a percent of fields							
1960	100	27	5	10	2	5	5	73
1961	100	29	5	10	3	5	6	71
1962	100	30	5	11	3	6	6	70
1963	100	30	5	11	4	5	6	70
1964	100	30	5	11	4	5	6	70
1965	100	30	4	11	4	5	6	70
1966	100	27	4	10	4	5	6	73
1967	100	26	3	9	4	5	6	74
1968	100	26	3	9	3	5	6	74
1969	100	25	3	8	4	5	6	75
1970	100	24	3	7	3	4	6	76
1971	100	22	3	7	3	4	6	78
1972	100	21	3	7	3	4	6	79
1973	100	21	2	6	3	3	6	79
1974	100	19	2	6	3	3	6	81
1975	100	18	2	5	2	3	6	82
1976	100	17	2	5	2	3	5	83
1977	100	18	2	5	2	3	5	82
1978	100	18	2	5	2	3	5	82
1979	100	18	2	5	2	4	5	82
1980	100	18	2	6	2	3	5	82

[1] Including environmental sciences.
[2] Including statistics and computer specialties.
[3] Excluding history and including psychology.
NOTE: Percents may not add to 100 because of rounding.
SOURCES: National Center for Education Statistics, Department of Education, and National Science Foundation.

Table B-27. Doctoral degrees awarded by field: 1960-80

Year	All fields	Science and engineering fields						All other fields[4]
		Total	Physical sciences[1]	Engineering	Mathematical sciences[2]	Life sciences	Social sciences[3]	
	Number							
1960	9,733	6,263	1,861	794	291	1,660	1,657	3,470
1961	10,413	6,721	1,993	940	332	1,682	1,774	3,692
1962	11,500	7,438	2,097	1,216	388	1,867	1,870	4,062
1963	12,730	8,220	2,428	1,357	483	1,976	1,976	4,510
1964	14,325	9,224	2,527	1,664	588	2,219	2,226	5,101
1965	16,341	10,477	2,865	2,074	685	2,539	2,314	5,864
1966	17,949	11,458	3,059	2,301	769	2,711	2,618	6,491
1967	20,406	12,984	3,504	2,604	830	2,967	3,079	7,422
1968	22,938	14,418	3,671	2,848	970	3,503	3,426	8,520
1969	25,747	15,972	3,919	3,251	1,065	3,804	3,933	9,775
1970	29,500	17,738	4,403	3,433	1,224	4,164	4,514	11,762
1971	31,873	18,933	4,501	3,500	1,238	4,554	5,140	12,940
1972	33,044	18,993	4,255	3,503	1,281	4,446	5,508	14,051
1973	33,756	18,986	4,076	3,362	1,232	4,499	5,817	14,770
1974	33,048	18,307	3,764	3,147	1,209	4,303	5,884	14,741
1975	32,953	18,358	3,710	3,002	1,147	4,403	6,096	14,595
1976	32,946	17,861	3,506	2,833	1,003	4,359	6,160	15,085
1977	31,718	17,411	3,414	2,642	964	4,263	6,128	14,307
1978	30,872	17,047	3,233	2,423	959	4,365	6,067	13,825
1979	31,200	17,230	3,321	2,494	977	4,495	5,943	13,970
1980	30,982	17,195	3,151	2,479	963	4,710	5,892	13,787
	As a percent of fields							
1960	100	64	19	8	3	17	17	36
1961	100	65	19	9	3	16	17	35
1962	100	65	18	11	3	16	16	35
1963	100	65	19	11	4	16	16	35
1964	100	64	18	12	4	15	16	36
1965	100	64	18	13	4	16	14	36
1966	100	64	17	13	4	15	14	36
1967	100	64	17	13	4	15	15	36
1968	100	63	16	12	4	15	15	37
1969	100	62	15	13	4	15	15	38
1970	100	60	15	12	4	14	15	40
1971	100	59	14	11	4	14	16	41
1972	100	57	13	11	4	13	17	43
1973	100	56	12	10	4	13	17	44
1974	100	55	11	10	4	13	18	45
1975	100	56	11	9	3	13	18	44
1976	100	54	11	9	3	13	19	46
1977	100	55	11	8	3	13	19	45
1978	100	54	10	8	3	14	19	44
1979	100	55	11	8	3	14	19	45
1980	100	55	10	8	3	15	19	45

[1] Including environmental sciences.
[2] Including statistics and computer specialties.
[3] Excluding history and including psychology.
[4] Including first-professional degrees such as M.D., D.D.S., D.V.M., and J.D. degrees.
SOURCE: National Academy of Sciences.

Table B-28. Graduate degree attainment rates: 1972-80

Science/engineering									
Bachelor's degrees		Master's degrees			Bachelor's degrees		Doctorates		
Year	Number	Year	Number	Rate	Year	Number	Year	Number	Rate
1970	264,122	1972	53,567	20.3	1965	164,936	1972	18,993	11.5
1971	271,176	1973	54,234	20.0	1966	173,471	1973	18,986	10.9
1972	281,228	1974	54,175	19.3	1967	187,849	1974	18,307	9.7
1973	295,391	1975	53,852	18.2	1968	212,174	1975	18,358	8.7
1974	305,062	1976	54,747	17.9	1969	244,159	1976	17,861	7.3
1975	294,920	1977	56,731	19.2	1970	264,122	1977	17,411	6.6
1976	292,174	1978	56,237	19.2	1971	271,176	1978	17,047	6.3
1977	288,543	1979	54,456	18.9	1972	281,228	1979	17,230	6.1
1978	288,167	1980	54,391	18.9	1973	295,391	1980	17,195	5.8

SOURCES: National Center for Education Statistics, Department of Education, National Academy of Sciences, and National Science Foundation

Table B-29. Distribution of selected activities of 1978 science/engineering bachelor's degree recipients in 1980

Field	Total[4]		Labor force		Total employed		Employed in science/ engineering		Employed in nonscience/ engineering		Full-time graduate students	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total, all fields	229,900	100.0	222,600	96.8	215,600	93.8	111,600	48.5	104,100	45.3	68,700	23.0
Scientists	177,400	100.0	170,400	96.0	164,100	92.5	64,200	36.2	99,900	56.3	65,000	26.8
Physical[1]	17,000	100.0	16,200	95.6	15,700	92.4	10,700	63.1	5,000	29.4	10,000	37.0
Mathematical[2]	17,700	100.0	17,300	97.7	16,900	95.5	12,600	71.3	4,300	24.1	2,200	11.1
Life	49,900	100.0	48,100	96.3	46,400	92.9	24,500	49.1	21,900	43.8	27,200	35.3
Social[3]	92,800	100.0	88,800	95.6	85,100	91.6	16,300	17.6	68,700	74.1	25,600	21.6
Engineers	52,500	100.0	52,200	99.6	51,600	98.3	47,400	90.3	4,200	8.0	3,700	6.6

[1] Includes environmental scientists.
[2] Includes statisticians and computer specialists.
[3] Includes psychologists.
[4] Full-time graduate students are excluded from the population total.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation.

Table B-30. Employed 1978 science/engineering graduates by field, level of degree, and field of employment in 1980

Field of degree	Field of employment[1]											
	Total employed	Chemistry	Physics and astronomy	Other physical sciences	Mathematical sciences	Computer specialties	Environmental sciences	Engineering	Life sciences	Psychology	Social sciences	Non-science/ engineering
	Bachelor's degrees											
Total	215,600	5,000	700	700	1,800	16,200	3,500	51,000	21,500	5,200	5,400	104,100
Chemistry	5,600	**2,700**	—	100	—	400	30	500	600	—	100	1,200
Physics/ astronomy	1,800	—	**400**	70	100	300	—	700	—	—	—	400
Other physical sciences	1,000	—	—	**300**	—	—	—	100	—	—	—	600
Mathematical sciences	10,100	—	—	—	**1,100**	4,100	100	700	100	—	—	3,800
Computer specialties	6,800	—	—	—	—	**6,000**	—	200	100	—	60	500
Environmental sciences	7,200	100	—	100	—	500	**2,500**	800	300	—	50	2,800
Engineering	51,600	30	—	—	100	1,400	200	**45,300**	400	—	—	4,200
Life sciences	46,400	2,100	300	100	—	1,200	400	1,500	**17,300**	300	500	21,900
Psychology	32,900	—	—	—	100	800	—	200	—	**4,900**	600	26,400
Social sciences	52,100	100	—	—	400	1,600	200	1,000	1,900	100	**4,100**	42,400
	Master's degrees											
Total	43,200	1,100	600	100	1,400	4,500	1,700	14,400	5,400	3,600	2,500	7,600
Chemistry	1,300	**1,000**	—	—	—	—	100	100	—	—	—	100
Physics/ astronomy	800	—	**300**	[2]	[2]	200	—	200	—	—	—	[2]
Other physical sciences	200	—	50	—	—	—	50	—	—	—	—	100
Mathematical sciences	2,600	—	—	—	**1,100**	700	—	200	—	—	—	600
Computer specialties	2,700	—	—	—	—	**2,300**	—	300	—	[2]	—	100
Environmental sciences	1,900	[2]	—	50	—	30	**1,300**	100	100	—	[2]	300
Engineering	15,200	[2]	100	—	100	1,000	100	**13,200**	—	—	50	600
Life sciences	7,600	60	—	60	[2]	[2]	80	200	**5,200**	—	100	1,800
Psychology	5,500	—	—	—	50	100	—	—	100	**3,500**	—	1,700
Social sciences	5,400	—	200	—	100	200	—	100	—	100	**2,400**	2,200

[1] Does not include full-time graduate students.
[2] Less than 50.
NOTE: Detail may not add to totals because of rounding.
SOURCE: National Science Foundation.

Table B-31. Number and percent distribution of employed 1978 science/engineering graduates by field, level of degree, and field of employment in 1980

Field of degree	Field of employment[1]											
	Total employed	Chemistry	Physics and astronomy	Other physical sciences	Mathematical sciences	Computer specialties	Environmental sciences	Engineering	Life sciences	Psychology	Social sciences	Non-science/ engineering
	Bachelor's degrees											
Total	215,600	5,000	700	700	1,800	16,200	3,500	51,000	21,500	5,200	5,400	104,100
	Percent											
Chemistry	5.600	**47.9**	—	2.1	—	7.3	0.5	9.1	10.2	—	1.6	21.4
Physics/ astronomy	1,800	—	**20.4**	3.7	5.6	14.8	—	35.2	—	—	—	20.4
Other physical sciences	1,000	—	—	**30.0**	—	—	—	10.0	—	—	—	60.0
Mathematical sciences	10,100	—	—	—	**10.9**	40.2	1.3	7.2	1.3	—	—	37.7
Computer specialties	6,800	—	—	—	—	**88.1**	—	2.3	16.9	—	.9	7.0
Environmental sciences	7,200	.9	—	1.1	—	6.6	**35.0**	11.7	4.0	—	.6	38.9
Engineering	51,600	.6	—	—	.2	2.7	.4	**87.8**	.8	—	—	8.1
Life sciences	46,400	4.6	.7	.3	—	2.6	.8	3.3	**38.9**	.5	1.1	47.1
Psychology	32,900	—	—	—	.3	2.4	—	.6	—	**14.8**	1.8	80.1
Social sciences	52,100	.2	—	—	.8	3.1	.4	2.0	3.6	.2	**7.9**	81.2
	Master's degrees											
Total	43,200	1,100	600	100	1,400	4,500	1,700	14,400	5,400	3,600	2,500	7,600
	Percent											
Chemistry	1,300	**76.7**	—	—	—	—	9.3	7.0	—	—	—	7.0
Physics/ astronomy	800	—	**35.7**	3.6	3.6	24.9	—	28.5	—	—	—	3.6
Other physical sciences	200	—	20.0	—	—	—	20.0	—	—	—	—	60.0
Mathematical sciences	2,600	—	—	—	**41.8**	26.2	—	7.4	—	—	—	24.7
Computer specialties	2,700	—	—	—	—	**84.7**	—	9.7	—	1.4	—	4.2
Environmental sciences	1,900	1.4	—	2.5	—	1.4	**69.5**	6.4	4.9	—	.7	13.2
Engineering	15,200	.3	.7	—	.7	6.4	.7	**87.0**	—	—	.4	3.8
Life sciences	7,600	.8	—	.8	.3	.5	.1	2.3	**69.5**	—	1.0	23.8
Psychology	5,500	—	—	—	.9	2.2	—	—	1.9	**64.1**	—	31.0
Social sciences	5,400	—	2.8	—	1.9	3.2	—	2.0	—	1.7	**44.3**	41.2

[1] Does not include full-time graduate students.

NOTE: Detail may not add to totals because of rounding.

SOURCE: National Science Foundation

Table B-32. Immigrant scientists and engineers by continent of last permanent residence: FY 1966-77[1]

Region	Permanent immigrants												
	Total	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Total	115,500	7,200	12,500	13,000	10,300	13,300	13,100	11,300	6,600	6,000	6,900	7,500	7,800
Europe	29,600	2,900	4,500	5,000	2,600	2,800	2,000	1,700	1,300	1,300	1,600	2,000	1,900
Asia	58,800	2,000	4,700	4,000	4,900	7,500	8,700	7,600	3,900	3,400	4,000	4,200	3,900
Africa	4,700	100	200	400	600	1,000	500	400	300	200	300	300	300
South America	4,200	400	500	600	400	300	400	300	200	200	200	200	400
North and Central America	17,100	1,700	2,500	2,900	1,600	1,600	1,400	1,200	800	700	700	800	1,200
Other	1,400	100	200	200	100	200	100	100	100	100	100	[2]	100
	Temporary immigrants												
Total	53,900	5,500	5,400	5,600	5,400	6,100	2,400	2,700	4,100	4,900	5,500	6,300	NA
Europe	23,200	2,300	2,500	2,600	2,400	2,700	1,100	900	1,700	1,800	2,500	2,700	NA
Asia	12,700	1,500	1,400	1,600	1,300	1,300	400	900	1,000	1,200	1,100	1,000	NA
Africa	2,300	300	200	200	200	200	100	100	200	200	200	4	NA
South America	5,200	500	400	400	500	700	200	300	400	500	500	800	NA
North and Central America	8,900	700	700	700	800	1,000	400	400	700	1,100	1,100	1,300	NA
Other	1,900	200	200	200	200	200	100	100	100	200	200	200	NA

[1] While these data represent last permanent residencies, permanent immigrant visas are granted on the basis of the country of birth. The resultant pattern of immigration, however, is not significantly different if counted by country of birth.
[2] Less than 100 people.
NOTE: Detail may not add to totals because of rounding. NA: Not available.
SOURCE: National Science Foundation, based on data of the U.S. Immigration and Naturalization Service, Department of Justice.

Table B-33. Occupational mobility of 1972 scientists and engineers as employed in 1978

1972 occupation	1978 occupation										
	Total	Engineers	Computer specialists	Mathematical scientists	Physical scientists	Environmental scientists	Biological scientists	Psychologists	Social scientists	Administration/management	Non-science/engineering
	Percent										
Total, all fields	831,000	48.9	6.2	2.2	7.8	2.4	6.4	2.5	2.7	14.1	6.9
Engineers	510,000	77.1	1.1	.1	.7	.1	.2	.1	—	15.1	5.5
Computer specialists	67,000	7.2	64.9	1.1	.5	.5	.1	.2	.3	19.7	5.7
Mathematicians	28,000	7.8	6.8	58.4	1.3	.4	.5	.1	1.8	12.5	10.5
Physical scientists	80,000	5.2	1.2	.3	70.8	1.8	3.0	—	.1	11.3	6.4
Environmental scientists	21,000	3.3	.5	.2	3.7	78.6	3.1	.1	.3	6.8	3.4
Biological scientists	68,000	1.2	.1	.3	3.9	.9	71.7	.2	.7	9.0	12.0
Psychologists	24,000	.1	.1	.3	.1	—	.6	79.6	1.5	7.1	10.6
Social scientists	32,000	.5	.3	1.3	.1	.2	.7	1.9	62.8	15.3	17.0

SOURCE: National Science Foundation.

Table B-34. Cumulative percentage of 1980 high school seniors taking varying amounts of mathematics and science coursework, by curriculum

Amount of coursework	Mathematics			Science		
	Academic	General	Vocational	Academic	General	Vocational
Total, including those with no coursework	100	100	100	100	100	100
1 year or more	98	90	89	96	88	83
2 years or more	86	57	52	74	44	35
3 years or more	55	22	18	41	13	9

SOURCE: National Center for Education Statistics, Department of Education

Table B-35. Percentage of 1980 high school seniors taking mathematics and science courses, by course title, sex, and racial/ethnic group

Course	Sex			Racial/ethnic group				
	All seniors	Male	Female	Hispanic	Black	White	American Indian/or Alaskan Native	Asian or Pacific Islander
Algebra I	79	79	79	67	68	81	61	88
Algebra II	49	51	47	38	39	50	32	76
Geometry	56	58	55	39	38	60	34	79
Trigonometry	26	30	22	15	15	27	17	50
Calculus	8	10	6	4	5	8	5	22
Physics	19	26	14	15	19	20	17	35
Chemistry	37	39	35	26	28	39	24	59

SOURCE: National Center for Education Statistics, Department of Education

Table B-36. 1981 college-bound seniors by number of years of study by subject

[Percent]

Years	Mathematics	Physical sciences	Biological sciences
None	0.4	9.0	5.0
One	2.0	32.5	60.7
Two	11.7	34.9	26.6
Three	27.5	18.7	5.2
Four	48.3	3.6	1.7
Five or more	10.1	1.2	.7

NOTE: Detail may not add to totals because of rounding.
SOURCE: Admissions Testing Program of the College Board, Educational Testing Service

Table B-37. Scholastic Aptitude Test (SAT) score averages for college-bound seniors by sex: 1970-81

Year	Verbal			Mathematical		
	Total	Male	Female	Total	Male	Female
1970	460	459	461	488	509	465
1971	455	454	457	488	507	466
1972	453	454	452	484	505	461
1973	445	446	443	481	502	460
1974	444	447	442	480	501	459
1975	434	437	431	472	495	449
1976	431	433	430	472	497	446
1977	429	431	427	470	497	445
1978	429	433	425	468	494	444
1979	427	431	423	467	493	443
1980	424	428	420	466	491	443
1981	424	430	418	966	492	443

SOURCE: Admissions Testing Program of the College Board, Educational Testing Service

Table B-38. Average number of monthly salary offers to bachelor's degree candidates in selected fields: 1976/77-1980/81

Curriculum	1976/77	1977/78	1978/79	1979/80	1980/81
Business	3,649	4,565	4,796	4,805	4,376
Humanities	1,018	1,010	658	581	675
Social sciences	1,275	2,008	1,947	1,783	1,629
Engineering:					
Chemical	4,026	5,293	6,310	7,029	7,428
Civil	2,178	3,529	4,424	4,181	4,416
Electrical	6,106	8,599	10,742	11,120	10,768
Mechanical	5,446	8,082	10,030	10,637	10,673
Petroleum	506	663	717	762	1,445
Agricultural sciences	652	657	257	551	490
Biological sciences	238	313	244	222	215
Chemistry	331	340	379	427	409
Computer sciences	1,323	1,803	2,268	2,569	2,876
Mathematics	554	679	756	823	729

SOURCE: College Placement Council

Table B-39. Average monthly salary offers to bachelor's degree candidates in selected fields: 1976/77-1980/81

Curriculum	1976/77	1977/78	1978/79	1979/80	1980/81
Business	$ 927	$ 993	$1,102	$1,218	$1,356
Humanities	810	871	983	1,074	1,204
Social sciences	863	930	1,020	1,131	1,246
Engineering:					
Chemical	1,389	1,513	1,642	1,801	2,030
Civil	1,185	1,288	1,402	1,554	1,775
Electrical	1,245	1,367	1,520	1,690	1,882
Mechanical	1,286	1,404	1,536	1,703	1,908
Petroleum	1,512	1,653	1,793	1,987	2,221
Agricultural sciences	924	965	1,046	1,192	1,287
Biological sciences	882	1,036	1,017	1,159	1,268
Chemistry	1,102	1,191	1,332	1,459	1,637
Computer sciences	1,123	1,266	1,401	1,558	1,726
Mathematics	1,073	1,185	1,324	1,475	1,624

SOURCE: College Placement Council

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